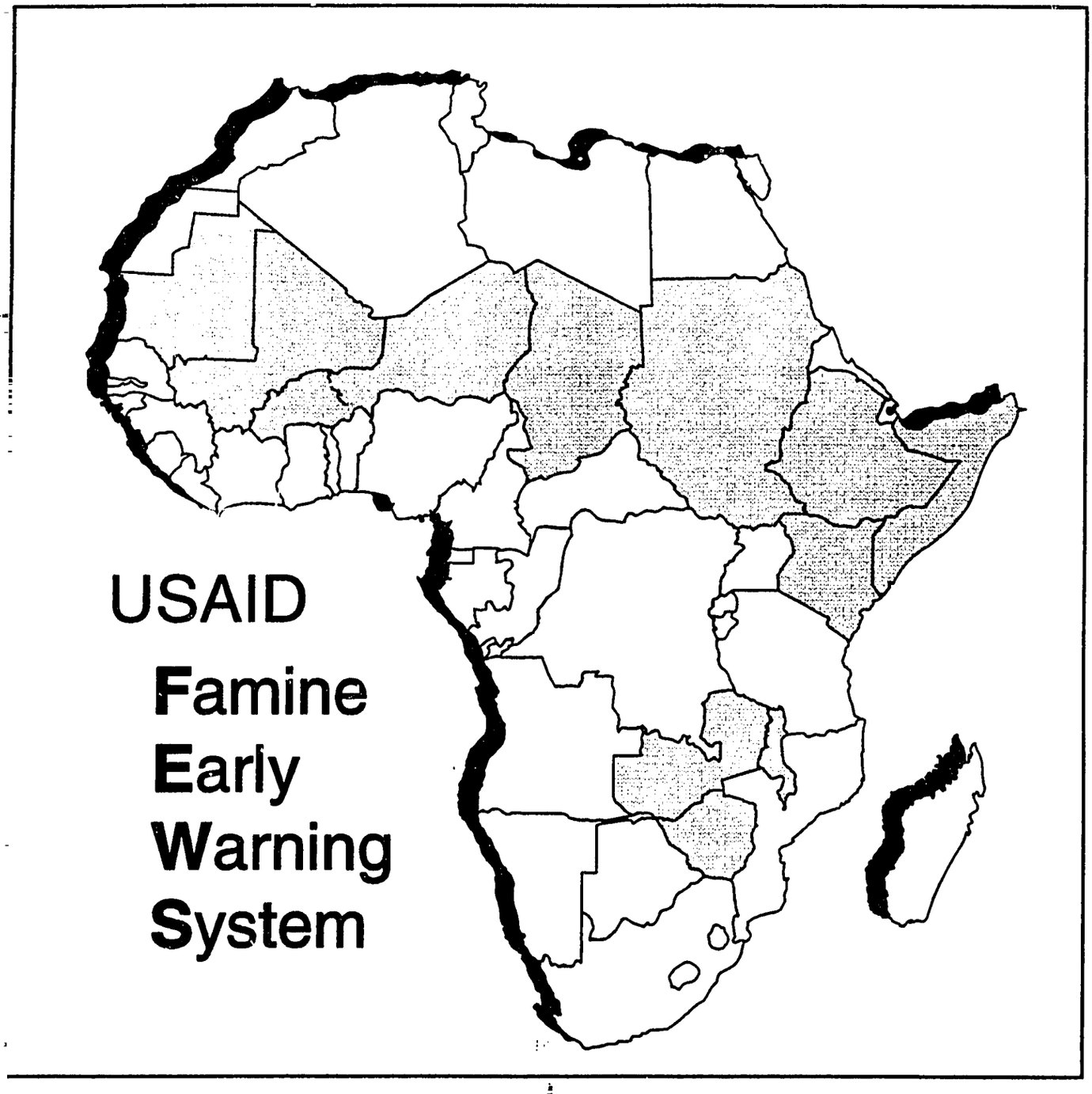
Tools and Methods



A description of computer software tools, techniques, and methodological approaches employed in the A.I.D. Famine Early Warning System (FEWS).

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SECTION 1.0: BRIEF HISTORY OF FEWS

1.1 ORIGIN

1.1.1 Conceived in Crisis

The year 1985 marked the occurrence of a major food crisis across the Sahel-Sudanian region in Africa, including a famine of considerable proportion in Ethiopia and the Sudan. Millions of people were affected across a wide arid and semiarid region just south of the Saharan desert.

Like many of its historical antecedents, this crisis was brought about as a result of numerous contributing factors. Although the proximate determinants were two years of successive drought and the absence or breakdown of institutional capacity to distribute food, numerous other factors were involved, including: (a) failure of some populations to fully recover from previous drought periods; (b) post-harvest losses due to improper storage; (c) very high market prices for grains; (d) lack of needed seeds for planting; (e) disruptive internal migration as a result of civil war; (f) very poor populations living on marginal lands, without family resources or social security; (g) loss of livestock due to drought/disease/slaughter; etc. As is also common in food crisis situations, those most affected are often geographically distinct, i.e., they inhabit or gather together in identifiable "crisis" areas[1].

1.1.2 Donor Responses

In mid-1985 the principal international donor countries and organizations met in Brussels to pledge assistance to mitigate the crisis at hand and to coordinate their responses. Because of the massive needs, by then apparent, and because of the number and variety of organizations involved (bilateral, multilateral, PVO, government, private) coordination was no easy task. Within AID/W, an Emergency Drought Relief Office was set up in the Africa Bureau to coordinate the U.S. response. Headed by a senior A.I.D. manager, this Office was responsible for coordinating the efforts of the Office of Foreign Disaster Assistance (OFDA), the Office of Food for Peace, and the Africa Bureau itself, as well as serving as the focal point for coordinating all U.S. assistance.

In the late summer of 1985, the Office of Technical Resources in A.I.D.'s Africa Bureau (AFR/TR) was requested to develop a data collection system to monitor events in the field, to help identify populations at risk, and to assist in the targeting of relief assistance. The timeframe given for these tasks was six weeks! Thus, the FEWS project was born out of an urgent need resulting from the emergency situation then prevailing, its goal being primarily to assist in targeting relief assistance and to provide "unbiased" estimates of severely affected populations

[1] Identifiable, but not necessarily identified. One of FEWS' first tasks was to help identify specific areas of crisis in the Sudan.

to A.I.D. policymakers. From the very beginning, it was clear that what was wanted was a system which would be able to develop reliable estimates of populations at risk *at the subnational level*, i.e., numbers and geographic locations.

Using OFDA emergency funding, FEWS was set up and run by AFR/TR. What later was to become known as "FEWS Phase I" began as a series of contracts with university, private, and other USG organizations. Given the short timeframe, contracts were hastily arranged with a variety of organizations to support activities geared to the present crisis, but molded with foresight to provide a longer-term decision support system for AID/W policymakers. At the outset, FEWS emphasis was on providing a system to support AID/W and USG decisionmaking needs, with little attention given to strengthening host country or other organization capacity to do early warning. Indeed, one of the justifications for FEWS development was the need to develop independent estimates in which AID/W could have confidence, and which could be compared with those provided by the many other players involved in emergency response activities.

1.1.3 The Case for Early Warning

The events of 1985-86 underscored the need for early warning, with the major donors having been caught largely unawares and facing only limited options. For example, in western Sudan very large numbers of persons were at risk of famine in Darfur and Kordofan provinces. Many had left their homes and were grouping in camps and villages. There was a need to move many tons of food, fast. It was already too late for other alternatives, though credible and reliable "early warning" would likely have given decision-makers a wider range of response options.

In addition to shipping massive quantities of food and other relief supplies, the U.S. provided 10 locomotives to the Sudanese government to speed up the pace of emergency food delivery over a very long East to West rail route across central Sudan. Not long after their arrival, very heavy rainfall washed out rail lines that brought food movements to a crawl, necessitating an expensive airlift using CH-46 helicopters. The airlift effort was itself hampered by a paucity of reliable information on numbers and locations of the most severely affected population. FEWS was called on to provide such estimates, including probable population numbers and geographic locations of villages, as well as detailed maps derived from satellite imagery to be used by the pilots. As the result of herculean efforts by FEWS contractors and other USG agencies -- as well as an important technical breakthrough in imagery processing[2] -- this information was provided in time to be useful. However, neither the locomotives nor the airlift would likely have been required had there been sufficient early warning and determination by the Government of Sudan and the donor community to take early action.

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[2] It was discovered that due to the unique settlement patterns and geography in the affected areas of Western Sudan, it was possible to "train" image processing equipment to identify villages and estimate their size using Landsat Thematic Mapper (TM) imagery coupled with "ground truthing". This is a very expensive process, probably unsuited to most other environmental situations.

1.1.4 An Ambitious Undertaking

From the outset, FEWS tried to accomplish things no other development agency or government had attempted. While some agencies, such as UNFAO, were doing analyses on a national level for specific indicators, and some were just beginning to use satellite-derived information, for example on "greenness", AID/FEWS endeavored to collect multidisciplinary data from diverse sources and to *integrate these data to provide the best, holistic and realistic snapshot of conditions in a spatial framework within each target country.* Satellite data, ground observations, market price data, rainfall, agricultural data (from planting, to yield, to production), health, nutrition, population, and other data all were to be collected, synthesized and analyzed on regional, national, and subnational levels, to identify not only vulnerable populations, but the specific conditions that made them so.

Recognizing that the underlying causes of famine and food stress are multidimensional, that often, socio-economic and political factors play a commanding role in food insecurity,[3] a multidisciplinary approach was adopted from the outset. It was FEWS doctrine to consider ***all*** relevant factors and indicators, rather than rely principally on national-level food balance sheets and crop production estimates as was then the common practice.

Not only was it necessary to identify and collect information from a wide variety of sources, it was also important to continually: (1) develop and refine early warning data sources in each FEWS country; and (2) push the technological limits in data processing, imagery interpretation, and in data integration methodologies.

1.1.5 Early Contract Arrangements

Between mid-1985 and 1988, the project operated as a series of interagency and outside contracts renewed on a semi- and yearly basis using OFDA emergency funding. These individually designed contracts entailed the coordination of many players. Core data collection services were provided in the field by Tulane University's School of Public Health. In Washington, Price Williams Associates (PWA) provided analysts to interpret collected data and to provide a variety of analytical products. Other contract work included: (1) the U.S. Department of Agriculture (USDA) evaluated the effectiveness and extent to which Landsat MSS data could be used for cropping, monitoring, and production analyses; (2) the engineering firm, Greenhorne & O'Mara undertook a GIS feasibility study and made recommendations; (3) ERIM in Ann Arbor, MI in collaboration with the U.S. Geological Survey EROS Data Center (USGS/EDC) in Sioux Falls, SD conducted a cropped area analysis in the Sudan using Landsat TM data to estimate total cropped area in the Sudan and to provide a basis for better crop production estimates; and (4) contract personnel from the University of Tennessee and the University of Pennsylvania

[3] Witness the 1993-94 crises in Sudan, Somalia, and Angola where socio-political factors have put millions of people at risk of famine.

developed a transportation model to assist with the routing of food and relief shipments. Separate interagency agreements included: (1) imagery, GIS, mapping, and data archiving services from the USGS/EDC; (2) NOAA/NESDIS supplied AVHRR[4] satellite images to FEWS analysts in Washington, and also furnished weather condition information and forecasts for the affected region; and (3) beginning in 1987, NASA conferred value-added services (image registration and archiving) in relation to NOAA's AVHRR satellite imagery. Other relatively small contracts and interagency arrangements have also played a part in FEWS work over the years.

1.1.6 FEWS Methodology in Phase I

It was believed that the best approach to gaining a first-hand account of existing and emerging conditions was to situate FEWS representatives in-country, specifically tasked with assembling the needed information from a variety of sources. Other analysts would be employed to analyze the collected data and to generate periodic reports.

To facilitate the data collection process, Tulane University's School of Public Health provided the field personnel for most of the countries being monitored.[5] These Public Health Assistants, or PHAs, were mostly public health specialists who identified, collected, and verified existing data, and gathered any information they could pertaining to the crisis. The Washington-based analysts, charged with the synthesis and analysis of all these data and with writing the country reports for AID/W were provided by PWA. A geographer on detail from the Department of State helped coordinate the overall FEWS activity, together with the Assistant Director of AFR/TR. Others throughout A.I.D. contributed on a part-time basis, including staff from the Africa Bureau, OFDA, and CDIE.

Early FEWS methodology was characterized by a learn-as-you-go approach. This was a practical necessity, since: (a) very little time was allocated for FEWS startup; and (b) as outlined above, FEWS was attempting something quite new: the collection and integration of multidisciplinary data which fit into a loosely-defined but comprehensive conceptual model of vulnerability and famine[6]. Issues of which data to collect ("indicators") and how to process collected data (both mechanical and theoretical) were the focus of intense and repeated enquiry over several years. To some extent, they are *still* under refinement some eight years later. This is a reflection of the real world in which conditions are in a near-constant state of flux, necessitating a more flexible approach which takes advantage of changing conditions.

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[4] AVHRR = Advanced Very High Resolution Radiometer (a NOAA satellite capable of sensing reflected light energy in several bands).

[5] Although monitored by FEWS, Ethiopia did not have a FFR in the field.

[6] A more detailed insight into early approaches taken may be gained from a perusal of Annex I, "Early FEWS Databases".

Convergence of Evidence. From the outset, FEWS I used a *convergence of evidence* approach to assessing food security conditions, seeking to employ multiple indicators to confirm each of its conclusions wherever possible. The key to identifying food security problems lies in the ability to identify -- as early as possible -- aberrations or departures from the norm with respect to key indicators (e.g., rainfall, "greenness", market prices, migration, livestock, household income levels, health and nutritional levels, physical security, etc.). Using the *convergence of evidence* approach, corroborating data was routinely sought whenever a departure from the "norm" was detected, much as a detective or an intelligence analyst seeks clues to explain individual happenings. The richness of this methodological approach turns on three key factors: (1) correct choice of indicators; (2) correct perception of what is "normal", based on an accurate historical database; and (3) skilled interpretation of data and events by the analyst.

As noted above, especially during the first two to three years, FEWS I devoted much time to the intriguing question of indicators: what should be looked at and why? The matter is exceedingly complex when moved from the theoretical to the practical realm, i.e., from how things ought to work to how they really do work. This was especially true when one considers which data were actually available (or could have been made so) in the FEWS countries, thereby placing practical limits on data to be fed into the analytical engine. FEWS I tried to look at all the possibilities, i.e., all sources of data which seemed relevant to food security issues. Increasingly, however, attention has been given wherever possible to the estimation of household income levels, in collaboration with FAO and IFPRI.

Food Accounting. The first methodology tried was food accounting. This was an attempt to extend a true cereal balance ((production + carry-over stocks + imports) - (exports + non-human consumption + human consumption)) to subnational units, including ways of using historical production to estimate on-farm stock. The methodology foundered on the question of food availability through commercial routes and through private transfers (familial and local charity).

Food Accounting Plus Indicators. The second major methodology attempted during FEWS I was that utilized in the final vulnerability assessment (June 1989 -- the first vulnerability assessment was done in June 1988). This approach combined food accounting with indicators. A tripartite picture of vulnerability was proposed: a food budget or account on a per capita basis; factors that would impede or enhance access to food such as income sources other than farming and herding, market data, civil security as it affects market function, etc.; and actual food security outcomes such as malnutrition, anomalous population movements, reports of famine, etc. The second step (factors impacting food access) required an understanding of socioeconomic groups within the FEWS countries. The data for creating each of these pictures were geo-referenced and made into maps. Each "picture" part was produced as an individual map layer, and then the three layers were combined to determine the most vulnerable areas in each country.

1.2 FEWS TODAY

1.2.1 Shift in Emphasis

In it's eight years of operation, the FEWS project has evolved from a quickly conceived response to a sudden crisis, to an institutionalized project in A.I.D.'s portfolio. FEWS was formally organized into an Africa Bureau project with DFA[7] funding in mid-1989. The new project was designated FEWS II. As the crisis conditions of the mid-1980s abated, subtle changes in the project's original mandate occurred and FEWS shifted to a longer-term emphasis: disaster prevention.

Over the course of FEWS I, the skills of and tools available to the PHAs became immensely more sophisticated, contributing to the shift from Washington-based analysis to field-based analysis. The focus changed from strict data collection and transmittal to Washington, to in-country analysis. In addition, during FEWS I the initial health orientation of field work changed to placing a greater emphasis on food supply statistics and economics.

1.2.2 The Birth of FEWS II

A.I.D.'s decision to continue the FEWS work as a formal project was not taken lightly. There were numerous arguments for and against such action, both in AID/W and in the USAID field missions. Arguments against FEWS continuation tended to be grouped in two categories: (1) the belief that famine avoidance and disaster preparedness and response were not the "mainstream" work of A.I.D., and were better left to the U.N. and other donors (especially now that the crisis was over); and (2) the belief that FEWS was providing a service which was largely redundant in view of other "early warning" activities carried out by the U.N., USAID missions, regional organizations and some of the recipient countries themselves. Voices raised in support of a continued FEWS effort reflected: (1) the continuing need for an early warning capability seen by A.I.D. as being relatively unbiased; (2) the growing interest in early warning approaches and methodologies developed during FEWS I; (3) the belief that while famine avoidance and disaster mitigation were not "mainstream" A.I.D., they were very likely to become continuing features of A.I.D.'s work in Africa in the coming years, due to a confluence of natural and manmade factors; (4) that data collection and analysis methodologies pioneered during FEWS I could become useful for broader A.I.D. work, especially in natural resource management, agricultural assistance, and other technical areas; and (5) the desire never to be caught again, without adequate warning and information, in the type of crisis which spawned the FEWS project.

The forces "for" FEWS won out, and FEWS II was approved in the spring of 1989. From that point forward, FEWS ceased to be a project wholly or largely for the benefit of AID/W decisionmakers. In FEWS II, the USAID field missions assumed a larger role in directing and

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[7] DFA - Development Fund for Africa. FEWS was no longer financed by OFDA emergency funds.

collaborating in the work of the project, using its methodologies and resources to develop and/or enhance in-country early warning capability. FEWS Field Representatives (FFRs - formerly known as PHAs under FEWS I) were empowered to assist USAID missions, host government organizations, and others through their training, equipment, software tools, and technical backstopping. In all but one case, the capacity of the FFRs was enhanced thru the hiring of FFR Assistants: local professionals who became alter egos and could serve as a continuing in-country resource. As a practical necessity, some FEWS resources were used to develop host-country early warning capability, especially in helping to open up critical data streams needed for analysis. The locus of country-specific analysis shifted from FEWS/W to the field, providing for more timely assessments and for the assimilation of FEWS work into the USAIDs and collaborating host country institutions.

1.2.3 Shifts and Expansion of FEWS' Focus

In 1992, as a food crisis was developing rapidly -- the result of a devastating drought in Southern Africa -- a decision was made to expand FEWS activities into four countries: Kenya, Malawi, Zambia, and Zimbabwe. While the role of FEWS differed somewhat in each of these countries -- and differed also from that of FEWS in the Sahel-Sudano region -- in general the FEWS role was one of helping to gather and process data to be used for targeting emergency food aid. Just as had been the case in the Sahel in 1985, FEWS was thrown into a crisis situation without benefit of having established data sources or an historical database with which to work. Nonetheless, approaches and methodologies already developed within FEWS elsewhere were found to be applicable in the early warning situations, helping the project to make a useful contribution.

While some countries have been added to the FEWS roster, others have been dropped. Mozambique is no longer a FEWS country. Somalia was an original FEWS country, but because of the civil war in that country, the USAID Mission in Mogadishu closed, and the U.N. took primary responsibility for food distribution. FEWS coverage discontinued after July 1986. However, as of March 1994, Somalia once again is monitored by the FEWS project. FEWS stopped full coverage of the Sudan in June 1992, following the May 1992 down-sizing of USAID's presence in Khartoum and its decision to no longer do development work. In early 1994, a regional FEWS office was opened in Nairobi for the express purpose of tracking conditions in Somalia and southern Sudan. As well, Ethiopia now has a FFR in-country due to the resolution of the civil war in that country and USAID's shift in focus from emergency relief only to development work. FFR's continue work in Mali, Chad, Burkina, Mauritania, and Niger, a few of the more drought-prone countries in the Sahel.

Increasingly in the past year, FEWS has been called upon to provide information on non-FEWS countries. This is seen as both a problem for the project (limited data and in-country experience, limited staff resources) and an opportunity for the project to demonstrate the application of its analytical methodologies in early warning situations.

1.2.4 Evolution of FEWS Methodology in Phase II

Most persons associated with the FEWS project feel that it has struck a good balance between rigor and flexibility in its methodological approach as appropriate to the conditions at hand in a given setting. The development and use of FEWS data managers reflect a felt need for rigor in the organization and analysis of key databases: rainfall, agricultural data, population data, and market price data. Standardized processing of satellite imagery for "greenness", "cropped use intensity", and rainfall estimation is a feature of Phase II analysis. The work of Thomas Downing (University of Birmingham), Frank Riely (FEWS Analytical Support Office), Charles May (former FEWS Economist) and numerous others in defining socioeconomic vulnerability to famine represents another attempt to provide an overall model of vulnerability for use by FEWS. At the country level, individual annual plans -- developed by the FFRs and reviewed in group workshops -- include standardized approaches to the collection and analysis of available data in each country. The annually-prescribed Trimestral Reports (Vulnerability Analysis, Preharvest Assessment, and Postharvest Assessment) and the monthly Food Security Operations Cables (FSOCs) represent yet another example of how the project has tried to adopt a standardized approach where possible, while retaining flexibility to meet the changing conditions[8] in each country.

FEWS II does not do the monthly country reports which were a feature of FEWS I. Rather, it was planned that three major reports would be done at approximately the same time each year. These reports, called Trimestrals, are: (1) the Vulnerability Assessment Report, done before the growing season each year; (2) the Preharvest Report, done during the growing season; and (3) the Postharvest Report, done after the growing season when more complete harvest and related data are available.

The FEWS II approach to vulnerability assessment is derived from the work of a consultant who was asked to review approaches used in FEWS I and to further refine and focus the FEWS methodology. His work helped to move the focus of FEWS enquiry to the level of household decisionmaking: three *domains* were identified (national/household/individual) and translated into economic terms: *macroeconomic/microeconomic/nutrition* or *supply/demand/utilization.* These constructs were in turn used to structure the vulnerability assessment reports in June 1990 (the first done under FEWS II): Food Availability, Food Access, and (the summary) Vulnerability Update sections. Populations were grouped according to socioeconomic status in order to better estimate food access. This is the basic methodological model used in FEWS II. For the June 1991 VA, the FEWS Matrix of Vulnerability was developed in order to make unambiguous word usage across countries.

In the field, application of the basic methodology has differed according to data availability. In data-poor countries, the VA has been fairly descriptive, including estimates of the sizes of

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[8] Changing conditions include socio-political factors, data availability, skills availability, and data management capability as well as the many factors affecting vulnerability.

socioeconomic groups, assessments of factors having impact on each group's ability to gain access to food, assessments of how each group's access had actually been faring given behavior of related indicators, and an assessment of vulnerability levels. In countries which are more data-rich, attempts have been made to turn each factor into a geographic layer for use in GIS analysis. This latter effort has led to two major methodologies being used this year (1994). In one method, each layer/indicator of income generation is analyzed to find anomalous areas (positive and negative), which are scored. Layers are then combined to find the most vulnerable area (a paper is being prepared to describe this methodology more thoroughly). The second method involves the monetizing of income generating activities, including agriculture, after which a population's abiiity to purchase food with their income is determined using a subnational layer of food prices. No doubt further methodological refinements will be made in FEWS III.

1.2.5 Role of FEWS in Decisionmaking

"Baptism by fire" has characterized the project's evolution. In the beginning, it may have appeared that FEWS was too ambitious. However, the driving force powering the project has always been data integration. With much trial and error, and the advances in technology, the FEWS project has accomplished what it set out to achieve. Today, FEWS can be viewed as an information system -- one component in an overall food security strategy -- designed to strengthen the early warning capability within A.I.D. At the same time, the project has reinforced host country early warning efforts and has promoted a common approach to early warning in the international community.

In essence, FEWS was and is a specialized *decision-support* system which aims at improving the quality of decisionmaking with respect to famine avoidance and mitigation. A schematic representation of this primary function is shown in Figure 1.1.

1.2.6 Contract Changes

While FEWS has retained its primary strategy, that being a multidisciplinary approach to identifying populations at risk, changes have occurred within the contract arrangements supporting this strategy. In FEWS II, Tulane University provides most in-country personnel, now known as FEWS Field Representatives (FFRs), as well as some professional staff in Washington. The Pragma Corporation, a subcontractor, provides professional staff and administrative services for U.S.-based staff and for one FFR. The USGS/EDC continues to furnish services in GIS support, data archiving, and imagery processing. NOAA continues to supply imagery to NASA, which in turn, continues the imagery archiving and processing services, now jointly funded by FEWS and UNFAO. The University of Reading in England provides cold cloud duration data from GOES imagery to estimate rainfall on a synoptic basis. However, PWA, USDA, Greenehorne and O'Mara, ERIM, and the Universities of Tennessee and Pennsylvania, contractors under FEWS I, no longer are under contract for FEWS services.

Role of FEWS in Decision Support

Multi-sector Data

Agricultural, demographic, health and nutrition, market price, rainfall, vegetative vigor, time-series data

Physical Data

Boundaries (political, geographic, administrative), cropped areas, soil types, roads, rivers, physical facilities locations, etc.

CURRENT EVENTS DATA

POLICY AND PROGRAM DATA

FEWS DECISION-SUPPORT FUNCTIONS

Use of Specialized Data Analysis and Data Integration Tools

Experienced Specialists Use Critical Analysis and Human Judgment

Use of Standardized Analytic and Performance Templates

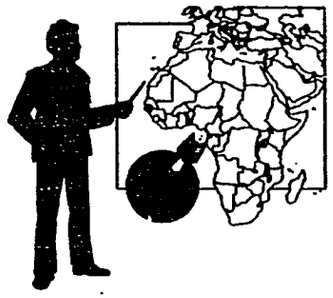
Periodic Special Analyses Done and Special Analyses on Request

Use of Advanced Presentation Tools and Techniques

Detailed Spatial Analyses at Local, Provincial, National & Regional Levels

Spatial and Graphical Information Which Can Be Shared Widely

Meetings Centered Around Current INFORMATION not "data" or heresay



Detailed Targeting Analysis Centered on Modifiable Program Elements

Figure 1.1

1.2.7 Programmatic Changes

1.2.7.1 FEWS Analyses

Under FEWS I, it was thought that a separation between data collection and data analysis functions would help keep the analyses more "objective". In retrospect, however, this proved to be more theoretical than practical. Once the project started to evolve, many of the FFR's wanted in-country analytical capability and some began writing their own country reports. Indeed, as FEWS matured, and as the Missions and host countries warmed up to the project, it became apparent that most of the country-level analysis could and should be done in the field. In part this was due to pressures put on the FFRs in each country to provide "instant" analyses without delays involved in waiting for Washington's analyses to be completed and re-exported to the field; in part due to the need to have something valuable for the FFRs to trade, i.e., something which could sustain the needed data streams from the host governments and other organizations; and partly due to technological advances, the power of pc's, software products, and the honing of the FFRs technical skills.

Since the start of FEWS II, most in-country analysis and reports are done by the FFR's. Three major reports are produced in the field each year: vulnerability assessments, preharvest assessments, and postharvest assessments. Only modifications to these reports are made in Washington. In addition, each month the FFR drafts or contributes to a Food Security Operations Cable (FSOC) sent by each Mission in the Sahel. The monthly country reports, originally done by FEWS analysts in Washington under FEWS I, have been dropped in FEWS II.

1.2.7.2 FEWS Reports

Under FEWS I, Washington-based analysts synthesized and analyzed data coming in from the field and wrote country reports for policy makers in AID/W. These country reports were issued on a monthly basis, but soon it became obvious this wasn't frequent enough to provide the up-to-date information sought by many individuals. In 1987, the Washington-based analysts decided to issue bulletins every ten days to keep decisionmakers abreast of the most current information coming in from the field. These bulletins are satellite-imagery driven and provide more frequent reporting on the growing season, i.e., any information pertaining to and influencing crops such as rainfall data, pest and insect management, etc., and how this may impact food security. This proved to be a popular product which was widely distributed and read, and thus, was carried over to FEWS Phase II.[9]

Today, as mentioned above, the monthly country reports are no longer written by the FEWS/W staff. However, the FEWS/W staff is responsible for writing the regional analyses, the

[9] This was not planned for in the creation of FEWS II. Rather, it was done by the contractor on its own initiative.

amalgamation and publication of the Trimestral reports, the FEWS Bulletins and the on-line product, FEWSNEWS, special analyses and reports requested by AID/W and other interested organizations, and for providing technical assistance and support to the FFR's.

1.2.7.3 Use of Tools

FEWS has become more regularized as well as more flexible in terms of the kinds of information it treats as well as the analytical and presentation tools it uses. The original data collection instrument was a hastily conceived and written database program that standardized data storage and reporting for a small set of indicators. This soon proved to be inadequate for FEWS needs and was abandoned in favor of using more flexible tools to organize a wider range of multidisciplinary data. Under FEWS I, IDA (Image Display and Analysis) was developed by a FEWS/W contractor to allow the display of satellite imagery on-screen and to enable data extraction and the printing of graphics products (using Pizazz Plus). This was a single-purpose, easy-to-use tool which found wide acceptance in FEWS and the international community. It continues to be a mainstream FEWS tool, having gone through several updates.

The concept of "FEWS tools", i.e., customized software developed specifically for FEWS as well as off-the-shelf software adapted to FEWS needs, grew out of FEWS experience in Phase I and early in Phase II. As data collection, management, and analysis functions became more sophisticated it became clear that more specialized tools were required, especially for data management. Several analysts in the field, FEWS/W, and at USGS/EDC had already been experimenting with various database and spreadsheet packages, adapting them according to individual country circumstances and requirements. In a few instances, this led to the development of generic software tools applicable across all FEWS countries (e.g., PRIX, SPACEMAN, VAST). More often, however, it led to the development of literally hundreds of spreadsheets and databases which had little common structure, even in the same country. Clearly, there was a need for FEWS to develop standardized "data managers" to help organize the FEWS database of, e.g., rainfall statistics, market prices, agricultural statistics, demographic data, etc. Accordingly, specialized data managers, including AGMAN, RAINMAN, and PRIX, were developed to organize, analyze, and present FEWS agricultural, rainfall, and price data, respectively. Demographic data is now being organized using REDATAM-Plus, a product developed in Latin America by the U.N. As GIS packages for microcomputers became more practical they, too, have been integrated into FEWS work in the field and in Washington.

The use of tools makes sense. If certain tasks and/or products are routinely done, and resources are limited, as in FEWS case, having a standardized format saves time, money, and frees up labor for other tasks. In addition, the standardization of reports and other products compensates somewhat for lack of specific subject-area skills. Not everyone is a meteorologist, but if rainfall data are structured in a fixed format and analyses are performed in standardized ways (e.g., as is the case with RAINMAN), with minimal training one can learn to manipulate and interpret this information. The same pertains with respect to analyses of satellite imagery, market prices, demographic data, and other sectoral data.

1.2.7.4 FEWS Personnel

Lastly, the FEWS project has benefitted from the continuity of it's personnel. Several of the analysts and FFRs have been with the project from near its inception. The original Principal Investigators of the Tulane and USGS/EDC contracts remain the same; the geographer attached to AID/W also continues his association with FEWS, now as a USGS/EDC employee. In addition to their unique sets of FEWS-related skills, project personnel provide the stability and the institutional memory of the FEWS project. Without these, it would have been next to impossible to accomplish all that FEWS has.

ANNEX 1

Early FEWS Databases

During the first two years of operation, FEWS developed a number of specialized databases in response to the then evolving famine and post-famine conditions across the Sahel-Sudano region in Africa. These included ***generic databases*** intended for use by FEWS field representatives to help target and organize their data collection efforts, as well as a number of ***specialized databases*** used in the field and in Washington. Excerpts of four such specialized databases (AIRDROP, SITES, LANDSAT, CABLES) are shown below.

Excerpt from AIRDROP database (food dropped by helicopters in western Sudan):

Date	From	To	Lat	Long	Sorties	Tonnage	Choppers	Hours	Source	Valid
08/19/85	NYALA	BARAM	1049N	2510E	3	8	3	4.5	HELI RECORD	11/25/85
08/21/85	NYALA	AMAGU	UNK.	UNK.	6	19	3	0	HELI RECORD	11/25/85
08/21/85	NYALA	BARAM	1049N	2510E	5	13	3	19.5	HELI RECORD	11/25/85
08/22/85	NYALA	BARAM	1049N	2510E	18	55	3	27.7	HELI RECORD	11/25/85
08/23/85	NYALA	BARAM	1049N	2510E	18	50	3	27	HELI RECORD	11/25/85
08/24/85	NYALA	RAHAD BARDA	1118N	2153E	15	44.4	3	25.3	HELI RECORD	11/25/85
08/25/85	NYALA	RAHAD BARDA	1118N	2153E	15	44.2	3	26.5	HELI RECORD	11/25/85
08/26/85	NYALA	KATILA	UNK.	UNK.	16	52	3	21.5	HELI RECORD	11/25/85
08/27/85	NYALA	KATILA	UNK.	UNK.	17	54.4	3	25.8	HELI RECORD	11/25/85
08/28/85	NYALA	BEDA	1243N	2154E	9	25.5	3	24	HELI RECORD	11/25/85
08/29/85	NYALA	GILLIZAN	1024N	2457E	6	18	3	12.5	KHARTOUM 12451	09/02/85
08/30/85	ZALINGEI	BEDA	1243N	2154E	8	20.6	3	22.6	KHARTOUM 12450	09/02/85
08/31/85	ZALINGEI	HABILA	1240N	2234E	17	54.8	3	25.6	KHARTOUM 12659	09/24/85
09/01/85	ZALINGEI	BEDA	1243N	2154E	1	2.5	1	0	KHARTOUM 12659	09/24/85
09/01/85	ZALINGEI	HABILA	1240N	2234E	15	51.5	3	26.2	KHARTOUM 12659	09/24/85
09/02/85	ZALINGEI	ARRARA	1243N	2208E	6	18.2	3	29.5	KHARTOUM 12659	09/24/85
09/02/85	ZALINGEI	BEDA	1243N	2154E	8	21.2	3	0	KHARTOUM 12659	09/24/85
09/03/85	ZALINGEI	MISTERIE	1307N	2210E	15	45	3	29.6	KHARTOUM 12659	09/24/85
09/04/85	ZALINGEI	MISTERIE	1307N	2210E	14	46	3	27.6	KHARTOUM 12776	09/06/85
09/05/85	GENEINA	KONGO HARAZA	1256N	2153E	12	34.4	3	27.4	KHARTOUM 12776	09/06/85
09/06/85	NYALA	BEDA	1243N	2154E	12	34.8	3	27.9	KHARTOUM 12776	09/06/85
09/07/85	NYALA	DIMSU	1058N	2435E	19	55.2	3	30.5	KHARTOUM 12839	09/24/85
09/08/85	NYALA	UMM DUKKEN	1110N	2300E	12	26.7	3	28.6	KHARTOUM 12839	09/24/85
09/09/85	NYALA	UMM DUKKEN	1110N	2300E	12	25.8	3	28	HELI RECORD	11/25/85
09/10/85	NYALA	BEDA	1243N	2154E	12	35.3	3	28.2	HELI RECORD	11/25/85
09/10/85	NYALA	KONGO HARAZA	1256N	2153E	1	0.7	1	0	HELI RECORD	11/25/85
09/11/85	NYALA	BEDA	1243N	2154E	12	35.7	3	28	HELI RECORD	11/25/85
09/11/85	NYALA	KONGO HARAZA	1256N	2153E	1	1	1	0	HELI RECORD	11/25/85
09/12/85	NYALA	BEDA	1243N	2154E	10	30.8	3	25.9	HELI RECORD	11/25/85
09/12/85	NYALA	KONGO HARAZA	1256N	2153E	1	2.5	1	0	HELI RECORD	11/25/85
09/13/85	NYALA	HAIGAR	1304N	2305E	9	32	3	29.6	KHARTOUM 13333	09/24/85
09/13/85	NYALA	UM SHALAYA	1307N	2257E	25	83.5	3	0	KHARTOUM 13333	09/24/85
09/14/85	NYALA	HAIGAR	1304N	2305E	25	83.5	3	25	KHARTOUM 13333	09/24/85
09/15/85	NYALA	KONGO HARAZA	1256N	2153E	25	79	3	31.2	KHARTOUM 13333	09/24/85
09/16/85	NYALA	KONGO HARAZA	1256N	2153E	12	35.5	3	28.7	KHARTOUM 13632	09/24/85
09/17/85	NYALA	BEDA	1243N	2154E	12	36.1	3	29.9	KHARTOUM 13632	09/24/85
09/18/85	NYALA	BEDA	1243N	2154E	12	36.1	3	29.3	KHARTOUM 13632	09/24/85
09/19/85	NYALA	UMM DUKKEN	1110N	2300E	10	22.8	3	27.2	KHARTOUM 13632	09/24/85
09/20/85	NYALA	KABAR	1110N	2300E	1	3	1	0	KHARTOUM 13632	09/24/85
09/20/85	NYALA	UMM DUKKEN	1110N	2300E	11	27.2	3	31.1	KHARTOUM 13632	09/24/85
09/21/85	NYALA	BEDA	1243N	2154E	1	2.8	1	0	HELI RECORD	11/25/85
09/21/85	NYALA	HABILA	1240N	2234E	19	52.2	3	29.9	HELI RECORD	11/25/85
09/22/85	ZALINGEI	HABILA	1240N	2234E	21	74.6	3	29.5	KHARTOUM 13719	09/25/85
09/23/85	ZALINGEI	KONGO HARAZA	1256N	2153E	13	38.8	3	27	KHARTOUM 13719	09/25/85
09/24/85	NYALA	KONGO HARAZA	1256N	2153E	13	41.4	3	29.8	HELI RECORD	11/25/85
09/25/85	NYALA	BEDA	1243N	2154E	12	35.3	3	28.7	HELI RECORD	11/25/85

ANNEX 1

Excerpt from SITES database (Feeding Centers and Shelters in Ethiopia):

COUNTRY	PROVINCE	SITE	LAT	LONG	ORGAN	STATUS	BENEFIC	VALID
ETHIOPIA	ERITREA	ADI KAYE	1451N	3922E	ICRC	A	330	09/10/85
ETHIOPIA	ERITREA	AKORDAT	1533N	3753E	ICRC,CRS	A	28857	09/10/85
ETHIOPIA	ERITREA	AREZA	1555N	3834E	ICRC,CRS/ECS	A	70000	10/10/85
ETHIOPIA	ERITREA	ASMARA	1520N	3856E	ICRC	A	3600	09/10/85
ETHIOPIA	ERITREA	BARENTU	1507N	3736E	ICRC,CRS	A	56740	09/10/85
ETHIOPIA	ERITREA	DECAMHARE	1504N	3903E	ICRC	A	35450	09/10/85
ETHIOPIA	ERITREA	FOOD FOR WORK	NA	NA	ICRC	A	2660	09/10/85
ETHIOPIA	ERITREA	JANNI	?	?	ERA	A	4000	05/21/85
ETHIOPIA	ERITREA	KEREN	1547N	3828E	ICRC,CRS	A	30428	09/10/85
ETHIOPIA	ERITREA	MASSAWA	1536N	3928E	ICRC	A	524	09/10/85
ETHIOPIA	ERITREA	SEGENEITI	1503N	3911E	ICRC	A	45569	09/10/85
ETHIOPIA	ERITREA	SENAFE	1441N	3925E	ICRC	A	13920	09/10/85
ETHIOPIA	ERITREA	SOLAMUNA	?	?	ERA	A	10000	07/15/85
ETHIOPIA	ERITREA	ZAHAT	?	?	ERA	A	4000	05/21/85
ETHIOPIA	GONDER	AREB GEBIYA	1131N	3840E	ICRC,FHI	A	22654	09/10/85
ETHIOPIA	GONDER	DEBARK	1308N	3755E	ICRC	A	11366	09/10/85
ETHIOPIA	GONDER	DEBAT	1301N	3746E	ICRC	A	1596	09/10/85
ETHIOPIA	GONDER	IBNET	1208N	3803E	WVRO,CONCERN,ICRC,LRCS	A	8329	09/11/85
ETHIOPIA	HARERGE	GEBLILU	1035N	4128E	CARE	A	1500	08/05/85
ETHIOPIA	HARERGE	KELAFO	0537N	4408E	UNHCR,LWF	A	7800	05/07/85
ETHIOPIA	SHOA	ANSOKIA	?	?	WVRO	A	24000	07/04/85
ETHIOPIA	SHOA	EFESON	1021N	3958E	SCF/US	A	125000	08/22/85
ETHIOPIA	SHOA	OMOSHELEKO	?	?	WVRO	A	26000	07/04/85
ETHIOPIA	SIDAMO	BODESSA	0650N	3740E	CONCERN	A	31700	07/26/85
ETHIOPIA	SIDAMO	HOBICHA (SANYO)	?	?	WVRO	A	6821	07/26/85
ETHIOPIA	SIDAMO	HUMBO	0644N	3745E	WVRO	A	14000	07/26/85
ETHIOPIA	SIDAMO	MEKANE YESUS	?	?	CDAA	A	12000	07/26/85
ETHIOPIA	SIDAMO	SODO AREA	0654N	3745E	FHI,SIM	A	45000	07/26/85
ETHIOPIA	SIDAMO	YABELO	0453N	3805E	CDAA	A	4500	07/26/85
ETHIOPIA	TIGRAY	ADI GODOM	1315N	3931E	ICRC	A	46008	09/10/85
ETHIOPIA	TIGRAY	ADIGRAT	1417N	3928E	ICRC,RRC	A	22320	09/10/85
ETHIOPIA	TIGRAY	ADWA	1410N	3854E	ICRC,ETH.ORTH.CHURCH	A	50000	09/10/85
ETHIOPIA	TIGRAY	ATSBI	?	?	ICRC	A	6315	09/10/85
ETHIOPIA	TIGRAY	AXUM	1408N	3843E	ICRC,ETH.ORTH.CHURCH	A	54250	09/10/85
ETHIOPIA	TIGRAY	INDA SELASSIE	1406N	3817E	WVRO	A	100000	09/06/85
ETHIOPIA	TIGRAY	MAYCH	1247N	3932E	ICRC,RRC	A	20048	09/10/85
ETHIOPIA	TIGRAY	MEHONI	1247N	3932E	ICRC	A	15066	09/10/85
ETHIOPIA	TIGRAY	MEKELE	1330N	3928E	ICRC,AFRICARE	A	43803	09/10/85
ETHIOPIA	TIGRAY	MEKELE (2)	1330N	3928E	RRC	A	3000	08/03/85
ETHIOPIA	TIGRAY	QUIHA	1329N	3933E	ICRC	A	8112	09/10/85
ETHIOPIA	TIGRAY	RAMA	1425N	3847E	ICRC	A	9552	09/10/85
ETHIOPIA	TIGRAY	WIKRO	1347N	3936E	ICRC,RRC	A	18751	09/10/85
ETHIOPIA	WOLLO	AJIBAR	1052N	3840E	WVRO	A	85000	11/15/85
ETHIOPIA	WOLLO	ALAMATA	1225N	3933E	ICRC,WVRO,RRC	A	150500	10/21/85
ETHIOPIA	WOLLO	ASAITA	1134N	4126E	LRCS	A	6500	08/05/85
ETHIOPIA	WOLLO	BATI	1111N	4001E	LRCS	A	33000	10/01/85
ETHIOPIA	WOLLO	DIDIGSALA	1253N	3958E	ICRC	A	47416	09/10/85
ETHIOPIA	WOLLO	HARBO	1055N	3947E	CONCERN,CDAA	A	8500	08/22/85
ETHIOPIA	WOLLO	KOREM	1230N	3932E	SCF/UK,CDAA,MSF,RRC	A	35000	07/24/85
ETHIOPIA	WOLLO	LALIBELLA	1202N	3902E	ICRC,WVRO,OXFAM,RRC	A	53824	09/10/85
ETHIOPIA	WOLLO	MILLE	1125N	4046E	ETH. RED CROSS	A	5000	06/10/85
ETHIOPIA	WOLLO	SANKA	1145N	3925E	ICRC,WVRO	A	43973	09/10/85

ANNEX 1

Excerpt from LANDSAT database (Landsat TM scenes for cropped area analysis in Sudan):

PATH	ROW	ORDERED	PRIMARY	BACKUP	SCENES	NOTES	VALID	CX
171	48	10/18/85	10/06/85		1	BEING PROCESSED GODDARD	11/15/85	CCT
171	49	10/18/85	10/06/85	10/22/85	1	BEING PROCESSED GODDARD	11/15/85	CCT
171	50	10/18/85	10/06/85	10/22/85	1	BEING PROCESSED GODDARD	11/15/85	CCT
175	53	10/18/85	11/03/85	11/19/85	1	PRIMARY HAD HEAVY CLOUD COVER-CCT NOT PROCESSED	11/14/85	ORD
178	49	10/18/85	10/23/85	11/24/85	1	LOSS OF VIDEO ON PRIMARY ACQUISITION	11/14/85	ORD
178	50	10/18/85	10/23/85	11/24/85	1	LOSS OF VIDEO ON PRIMARY	11/14/85	ORD
178	51	10/18/85	10/23/85	11/24/85	1	LOSS OF VIDEO ON PRIMARY	11/14/85	ORD
178	52	10/18/85	10/23/85	11/24/85	1	LOSS OF VIDEO ON PRIMARY	11/14/85	ORD
173	51	10/18/85	10/20/85		1	RECD 11/14/85; HAZY BUT USABLE; LAURIN TO BRING	11/14/85	REC
173	52	10/18/85	10/20/85	11/05/85	2	RECD PRIMARY 11/14; BACKUP 11/18; HOMES TO BRING	11/18/85	REC
173	53	10/18/85	10/20/85		1	RECD 11/14/85; HAZY BUT USABLE; LAURIN TO BRING	11/14/85	REC
174	51	10/18/85	10/27/85	11/28/85	1	BACKUP REC'D ERIM 12/4/85	12/10/85	REC
174	52	10/18/85	10/27/85	11/28/85	1	BACKUP REC'D ERIM 12/4/85	12/10/85	REC
174	53	10/18/85	10/27/85	11/28/85	1	BACKUP REC'D ERIM 12/4/85	12/10/85	REC
175	51	10/18/85	11/03/85	11/19/85	1	PRIMARY CCT REC'D ERIM 12/3/85 (ORIG. RPT WRONG)	12/10/85	REC
175	52	10/18/85	11/03/85	11/19/85	1	PRIMARY RECD/PROCESSED 11/18; HOMES TO BRING	11/18/85	REC
176	51	10/18/85	10/25/85	11/10/85	1	BACKUP RECD/PROCESSED 11/18; HOMES TO BRING	11/18/85	REC
176	52	10/18/85	10/25/85	11/10/85	1	BACKUP RECD/PROCESSED 11/18; HOMES TO BRING	11/18/85	REC
176	53	10/18/85	10/25/85	11/10/85	1	BACKUP RECD/PROCESSED 11/18; HOMES TO BRING	11/18/85	REC
177	50	10/18/85	11/01/85		1	CCT RECD/PROCESSED 11/18; HOMES TO BRING	11/18/85	REC
177	51	10/18/85	11/01/85		1	CCT RECD/PROCESSED 11/18; HOMES TO BRING	11/18/85	REC
177	52	10/18/85	11/01/85		1	CCT RECD/PROCESSED 11/18; HOMES TO BRING	11/18/85	REC
178	53	10/18/85	10/23/85		1	CCT RECD/PROCESSED 11/18; HOMES TO BRING	11/18/85	REC
179	49	10/18/85	10/30/85	11/15/85	1	BACKUP CCT ARRIVED ERIM 11/20/85	11/15/85	REC
180	49	10/18/85	10/21/85	11/22/85	1	PRIMARY CCT REC'D ERIM 12/3/85 (ORIG RPT WRONG)	12/10/85	REC
180	50	10/18/85	10/21/85	11/22/85	1	PRIMARY CCT REC'D ERIM 12/3/85 (ORIG RPT WRONG)	12/10/85	REC
180	51	10/18/85	10/21/85	11/22/85	1	PRIMARY CCT REC'D ERIM 12/3/85 (ORIG RPT WRONG)	12/10/85	REC
179	50	10/18/85	10/30/85		1	CCT ENROUTE SIOUX FALLS FROM GODDARD	11/14/85	SHP
179	51	10/18/85	10/30/85		1	CCT ENROUTE SIOUX FALLS FROM GODDARD	11/14/85	SHP
179	52	10/18/85	10/30/85		1	CCT ENROUTE SIOUX FALLS FROM GODDARD	11/14/85	SHP

ANNEX 2

CABLES Database

The three following pages show excerpts from the CABLES database which was used to track cable traffic pertaining to FEWS operations. The one-line summaries are particularly revealing in terms of the kinds of events which were taking place early in FEWS history, hence their inclusion here at some length.

Excluded from this listing are classified cables. These usually pertained to personnel movements (for security reasons), and other sensitive information on matters related to food security.

Excerpt from CABLES database (to track official cables related to FEWS operations):

COUNTRY	CABLE	DATE	TIME	SUBSTANCE
Burkina	Ouagadougou 03155	04/22/86	0939Z	Requests FEWS person to develop recommendations for FEWS/Bur.
Burkina	State	05/14/86	1900A	ADVISES State 142541 MISSENT ANOTHER POST; BEING RESENT TODAY
Burkina	Ouagadougou 03966	06/03/86	1428Z	REQUESTS FEWS ASSISTANCE IN TWO SEGMENTS OVER NEXT SIX MONTHS
Burkina	State 208801	07/02/86	2034Z	NOMINATES CHAS ALAN MAY FOR FEWS CONSULTANCY CF OUAGA 03966
Burkina	Ouagadougou 4733	07/10/86	1719Z	MISSION CONCURS CHAS ALAN MAY TDY BEGINNING 7/31 IF GOB APPR
Burkina	State 223841	07/17/86	0043Z	Gives ETAs for Chas. May (Aug 1 RK027) and N. Mock (o/a 8/3)
Burkina	Ouagadougou 04956	07/17/86	1733Z	Approval Trayfors/Olsson travel; suggests overland trip
Burkina	Ouagadougou 06200	08/27/86	1137Z	FEWS/Burkina Update No. 3 from Charles May
Burkina	State 271653	08/28/86	1655Z	Message for Charles May re PVA requested info (from Usdin)
Burkina	State 276981	09/04/86	0023Z	Details purpose/use of USDA/FAS ground travel Burkina
Burkina	Ouagadougou 07393	10/16/86	1233Z	Concurrence for proposed Mock visit per State 323496
Burkina	Ouagadougou 8637	12/09/86	1325Z	Requests assistance with Atlas mapping program
Burkina	Ouagadougou 8958	12/24/86	1435Z	Outlines prototype plan for transfer of FEWS to GOB
Burkina	State 004445	01/07/87	2116Z	Responds to Ouaga 8958 and request further detailed info
Burkina	Ouagadougou 00183	01/12/87	1934Z	FEWS transfer to GOB: additional details
Burkina	State 050090	02/20/87	0832Z	FEWS: Transfer Training Program (response to Ouaga 00183)
Burkina	Ouagadougou 01343	03/10/87	1818Z	Concurs proposed FEWS Assessment team visit 3/15-3/21
Burkina	Ouagadougou 01343	03/10/87	1818Z	Concurs 3/15-3/21 visit FEWS Assessment Team
Burkina	Ouagadougou 01696	03/25/87	0828Z	Report of FEWS/Burkina Africanization Team
Burkina	Ouagadougou 01873	04/01/87	1020Z	Confirms Kelly attendance Dakar and gives travel schedule
Burkina	Ouagadougou 01903	04/02/87	1015Z	FEWS/Burkina Transfer Program -- refines TA needed
Burkina	State 136151	05/06/87	0542Z	Lays out 2-track plan for Africanizatien of FEWS in Burkina
Burkina	Ouagadougou 02642	05/06/87	1342Z	FEWS/Burkina Status Report; advises 1 technician being trsfrd
Burkina	Ouagadougou 02713	05/07/87	1657Z	FEWS/Burkina transfer plan; comments on State 136151
Burkina	Ouagadougou 03083	05/21/87	1406Z	Burkina update 5/20: ag produc and CNLES personnel info
Chad	Ndjamena 4170	07/29/85	1430Z	CONCURS FEWS CONCEPT & SUGGESTS DR REMINGTON (CDC)
Chad	Ndjamena 4720	08/20/85	0652Z	MOH CONCURRENCE FOR DR. VINCENT BROWN
Chad	State 284944	09/17/85	0113Z	NOMINATION CABLE DR. VINCENT GENE BROWN AS FEWS FIELDPERSON
Chad	Ndjamena 5584	10/04/85	0625Z	CONCURRENCE DR. VINCENT BROWN AS FEWS FIELDPERSON
Chad	State 316343	10/15/85	1644Z	NOMINATION MICHAEL BROWN VICE VINCENT BROWN
Chad	Ndjamena 5864	10/18/85	1327Z	REGRET REJECT MICHAEL BROWN; NEED MED. PROFESSIONAL-MD MPH
Chad	Ndjamena 6215	11/07/85	1110Z	RPTS ON SCHWARTZ VISIT; OK FOR MOCK/EQUIP VISIT; REQ NOMINATN
Chad	State 369038	12/04/85	1757Z	NOMINATES DR EDOUARD VINCKE AS FEWS FIELDPERSON Chad
Chad	Ndjamena 6687	12/05/85	0625Z	OUTLINES EEC FEWS PLAN AND REQUESTS FEWS NOMINATION ASAP
Chad	Ndjamena 6727	12/06/85	0909Z	REQUESTS FULL BIODATA ON DR VINCKE, ESPECIALLY PSNS AND WORK
Chad	State 372586	12/06/85	1901Z	PROVIDES FULL BIODATA AS REQUESTED Ndjamena 6727
Chad	Ndjamena 6833	12/12/85	1316Z	MISSION DISAPPROVES NOMINATION DR VINCKE & REQUESTS AMCIT
Chad	State 016880	01/18/86	0018Z	NOMINATION DRS. SCHLOSSMAN AND BELGHATI AS FEWS FIELDPERSON
Chad	Ndjamena 0296	01/18/86	1110Z	ACCEPTANCE OF DR. NINA SCHLOSSMAN FOR FEWS FIELDPERSON
Chad	State 027991	01/29/86	0359Z	ADVISES NINA SCHLOSSMAN NOT AVAIL; NOMINATES DR. KHELGHATI
Chad	Ndjamena 0463	01/29/86	1300Z	ACCEPTS NOMINATION OF DR KHELGHATI
Chad	Ndjamena 0533	02/03/86	1115Z	CONFIRMS CONCURRENCE DR. KHELGHATI'S NOMINATION
Chad	State	02/05/86	1800A	GIVES ETA DRS KHELGHATI & MOCK (2340 3/8/86 AIR AFRIQUE 52)
Chad	Ndjamena 0620	02/07/86	0930Z	CONCURS DRS KHELGHATI AND MOCK TRAVEL PLANS

ANNEX 2

COUNTRY	CABLE	DATE	TIME	SUBSTANCE
Chad	Ndjamena 2235	04/28/86	0624Z	Concurs Nancy Mock visit 3rd week May & requests firm ETA
Chad	State 211052	07/04/86	0215Z	FEWS DRAFT COUNTRY REPORT FOR JULY FOR MISSION COMMENT
Chad	Ndjamena 03766	07/18/86	1119Z	Approval Trayfors/Olsson visit & recommends Nancy Mock accpny
Chad	Telex sent by Tulne	08/25/86	2330Z	Details proposed vulnerability/monitoring project for Woods
Chad	Ndjamena 04581	08/28/86	1330Z	Approval USDA team visit; requests fiscal info/delay end Sept
Chad	Ndjamena 04608	08/29/86	1543Z	Screwed up response to telex -- what can they be thinking?
Chad	Ndjamena 04613	08/30/86	0704Z	Requests status Schlossman replacement/co-PHA urgently
Chad	State 279308	09/05/86	1813Z	Provides fund cite for USDA/FAS team visit (charter aircraft)
Chad	State 279784	09/06/86	0228Z	Nomination Ann Riley as backup PHA during Schlossman absence
Chad	State 322180	10/14/86	1613Z	Nomination of Charlotte Sharp as FEWS PHA Chad
Chad	Ndjamena 05768	10/21/86	1429Z	Concurs Charlotte Sharp; requests continue looking for sr PHA
Chad	Ndjamena 06369	11/20/86	1143Z	VERY POSITIVE COMMENTS ON FEWS RPT #5; PROMISES SUBPREF. MAP
Chad	Ndjamena 00626	01/30/87	0849Z	Takes issue with Dec 86 FEWS report, pop section, etc.
Chad	State 026951	01/31/87	0623Z	Message for Charlotte Sharp from Usdin in lieu telex
Chad	Ndjamena 01430	03/07/87	0829Z	Protests FEWS Assessment notification and reluctantly concurs
Chad	State 085898	03/23/87	2259Z	Advises that Tulane will fund McBride attendance Dakar
Chad	Ndjamena 01907	03/30/87	1156Z	Confirms Sharp/McBride attendance Dakar; gives schedule
Chad	Ndjamena 02001	04/02/87	1208Z	Critique on FEWS Report No. 9 Chad and Niger; discussed Dakar
Chad	Ndjamena 02280	04/14/87	1454Z	Requests short-term supplmtl TA in data analysis/computer trg
Chad	Ndjamena 02810	05/08/87	1127Z	Summer consultants (approval) and biodata cand. Kinshasa trg
Chad	Ndjamena 03046	05/19/87	1058Z	Requests est. funding reserved for FEWS Chad to date/future
Chad	State 153919	05/20/87	1550Z	Nominates Tobi Saidel as 2.5 month database consultant
Chad	Ndjamena 03131	05/22/87	1140Z	Summer consultants: approval for Tobei Saidel and Chuck May
Chad	State 169794	06/03/87	1930Z	Advises that Chas. May nomination sent 5/15 State 148954 LOU
Chad	Ndjamena 03421	06/05/87	1103Z	Advises post did not receive State 148954 (C); advises unclas
Chad	Ndjamena 03547	06/11/87	0802Z	Again requests budget info FEWS/Chad; corrects telex number
Ethiopia	Addis Ababa 04424	07/29/85	0723Z	POSITIVE RESPONSE TO FEWS PROPOSAL
Ethiopia	State 276342	09/09/85	1923Z	NOMINATION DR. ZEIL ROSENBERG AS FEWS FIELDPERSON
Ethiopia	State 313786	10/10/85	2351Z	TEXT OF LTR TO MOH SENT PROPOSING DR ROSENBURG UP TO 12 MOS.
Ethiopia	Addis Ababa 06137	10/23/85	1043Z	TRANSMITS TEXT OF LTR ACTUALLY SENT TO MOH - WILL CABLE REPLY
Ethiopia	State	11/13/85		REPORTS ON MEETING WITH MINISTER OF HEALTH HERE
Ethiopia	Addis Ababa 06845	11/27/85	1308Z	MOH APPARENTLY UNWILLING APPROVE FEWS THUS PROJECT DROPPED
Ethiopia	State 357793	12/10/85	1918Z	AID/W AGREES NOT TO PRESS FEWS CONSULTANCY
Ethiopia	Addis Ababa 01345	03/02/87	1030Z	Revised ETA for Jim Pagano at Dakar Conference
Mali	Bamako 4644	07/30/85	1452Z	ENTHUSIASTIC APPROVAL FEWS PROPOSAL
Mali	State 316341	10/15/85	1643Z	NOMINATION CABLE FOR DR. STANLEY YODER
Mali	Bamako 6577	10/29/85	1113Z	APPROVAL DR YODER AND REQUEST HIS ETA
Mali	State 335261	11/01/85	0051Z	YODER ETA O/A NOV 11 -- WILL CONFIRM
Mali	Bamako 07741	12/30/85	0812Z	FIRST FEWS REPORT COVERING SIX ENTITIES -- Usdin HAS ALREADY
Mali	Bamako 00462	01/24/86	0759Z	SECOND FEWS REPORT ON 6 ENTITIES DATED 01/15/86
Mali	Bamako 02545	04/28/86	0940Z	Concurs visit Allan Hill o/a 4/27; requests further details
Mali	State 167859	05/28/86	2242Z	REQUEST CLEARANCE FOR FELIX LEE 6-DAY VISIT ETA 1700 6/9 RK47
Mali	State 213189	07/08/86	1610Z	Draft FEWS Country Report for July for Mission Comment
Mali	Bamako 04158	07/17/86	1507Z	Approval Trayfors/Olsson trip (cf AA/AFR visit same dates)
Mali	State 289296	09/15/86	1553Z	Advises USDA team Mali unable accommodate them on Sept 19
Mali	State 337410	10/18/86	2224Z	Summary of FEWS Report No. 5 for Francoise's comment/info
Mali	State 347677	11/06/86	0414Z	Advises Francoise that Usdin's been trying telex since 10/17
Mali	State 387965	12/16/86	0302Z	ETA Nancy Mock 2030 Hours Jan 8 UTA 851
Mali	Bamako 00837	02/10/87	1209Z	FEWS in Mali -- proposes use FEWS PHA in lieu drought staff
Mali	Bamako 01397	03/09/87	1153Z	Concurs FEWS Assessment team visit Stancioff and Kelly
Mali	State 068827	03/10/87	0207Z	Response to Bamako 00764 re drought staff needs and FEWS help
Mali	State 069641	03/10/87	1934Z	Advises FEWS Evaluation Team Stancioff/Kelly ETA 3/11
Mali	Bamako 01678	03/19/87	1500Z	Concurs 5-week TDY Dr. Ann Riley to do data inventory
Mali	Bamako 01909	03/31/87	1419Z	Advises Ben Hoskins, PSC Food Coord., will attend Dakar mtg
Mali	Bamako 02908	05/15/87	1010Z	FEWS Workplan - very supportive cable detailing proposals
Mali	State 168488	06/03/87	0537Z	Nomination of Catherine Toth as nearly warning PHA Mali
Mali	Bamako 03322	06/05/87	1233Z	Concurs nomination Catherine Toth and asks she arrive by 6/17
Multiple	Lusaka 02187	03/19/86	1454Z	1ST REPORT USDA SAM TEAM TRAVEL SOUTHERN AFRICA
Multiple	State 096261	03/28/86	0611Z	STATUS OF FEWS -- DETAILS CURRENT SITUATION AND OUTLOOK
Multiple	State 200171	06/25/86	0637Z	FEWS Country Reports: Lays Out Plan and Schedule -->9 posts
Multiple	State 222176	07/16/86	0122Z	Proposes visit Mali, Burkina, Chad, Niger by Trayfors/Olsson

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COUNTRY	CABLE	DATE	TIME	SUBSTANCE
Multiple	State 245571	08/08/86	2133Z	Proposes USDA ground travel Mali, Burkina, Niger, Chad
Multiple	State 257267	08/15/86	1826Z	Clarifies purpose USDA travel; video tapes; from ARLove
Multiple	State 272365	08/28/86	2304Z	Potential Applications of Remote Sensing for Locust Control
Multiple	State 031038	02/04/87	0314Z	Announces Tulane FEWS PHA meeting Dakar April 14-18
Multiple	State 076814	03/15/87	1512Z	Gives agenda Dakar mtg; references multiple incoming comments
Multiple	State	03/20/87	1800a	Gives meeting site FEWS Dakar and solicits mission inputs
Multiple	Dakar 04183	04/23/87	1000Z	Reporting cable on FEWS/Dakar conference
Niger	Niamey 05030	07/29/85	1500Z	POSITIVE RESPONSE TO FEWS IDEA
Niger	State 290769	09/20/85	2001Z	NOMINATION MR. SHAWN K BAKER AS FEWS FIELDPERSON
Niger	Niamey 07687	11/13/85	1337Z	OFFICIAL MOH APPROVAL FOR BAKER ASSIGNMENT 1 WEEK/1 YEAR
Niger	State 351159	11/15/85	1842Z	CONFIRMS BAKER AND MOCK ARRIVAL NOV 19 UTA FROM PARIS
Niger	State 017197	01/18/86	0608Z	NOTIFICATION INTENDED VISIT NANCY MOCK ARR 1/24 AIR AFR #27
Niger	Niamey 01249	02/15/86	1029Z	RAISES QUESTIONS (GOOD ONES) RE FEWS FOR DISC. AT DAKAR MTG
Niger	Niamey 4111	06/03/86	1618Z	EXPLAINS REASON FOR TURNDOWN PROPOSED LEVIN TDY State 154468
Niger	State 212787	07/08/86	0140Z	DRAFT FEWS COUNTRY REPORT FOR JULY FOR MISSION COMMENT
Niger	State	09/03/86	2000A	Provides fund cite for USDA/FAS team visit (charter aircraft)
Sudan	State 310056			REQUESTS DIR. BROWN'S APPROVAL WHEN HE ARRIVES AT POST
Sudan	Khartoum 10091	08/05/85	1128Z	LUKEWARM RESPONSE TO FEWS PROPOSAL -- 'MAYBE IN SIX MONTHS'
Sudan	Khartoum 13338	09/18/85	1314Z	TENTATIVE CONCURRENCE FEWS -- SUGGESTS ADDITIONAL PERSON(S)
Sudan	State 290758	09/20/85	2154Z	NOMINATION DR. PENELOPE NESTEL AS FEWS FIELDPERSON
Sudan	Khartoum 13783	09/26/85	1231Z	CONCURRENCE DR. PENELOPE NESTEL PENDING DIRECTOR BROWN APPRVL
Sudan	State 305253	10/03/85	2221Z	ADVISES DR M MOCK COULD ASSIST DR NESTEL PER REQ. KHAR. 13338
Sudan	Khartoum 14272	10/06/85	1256Z	REMINDER DIR. BROWN'S APPROVAL REQUIRED FOR NESTEL TRAVEL
Sudan	State 308707	10/07/85	2123Z	PROVIDES EQUIPMENT DETAILS AND NESTEL'S PASSPORT INFO
Sudan	Khartoum 14472	10/10/85	0735Z	REMINDER NEED BROWN'S APPROVAL FOR NESTEL TO TRAVEL TO Sudan
Sudan	Khartoum 15162	10/25/85	1042Z	APPROVAL ERIM TRAVEL AND ALT CROP IMAGING PLAN; FEWS REP
Sudan	State 328817	10/25/85	1623Z	NIACT IMMEDIATE REQUESTING CLEARANCES FOR NESTEL AND ERIM REP
Sudan	State 330067	10/26/85	0249Z	GIVES ETA DR NESTEL, PROMISES ETA ERIM/USDA, REQ. AUTH PD&S
Sudan	Khartoum 15437	10/31/85	1220Z	FUND CITE PD&S $40,000
Sudan	State 334767	10/31/85	1805Z	PROVIDES APPROX. ETAS FOR AG ASSESSMENT TEAM
Sudan	Khartoum 15656	11/05/85	1252Z	FIRST REPORT FROM HALEY ON GROUNDTRUTH -- VERY POSITIVE
Sudan	Khartoum 15688	11/06/85	0757Z	FURTHER POSITIVE DEVELOPMENTS ON GROUNDTRUTHING
Sudan	State 342954	11/07/85	2332Z	ETAS FOR COOK AND HICKS (ERIM)
Sudan	Khartoum 15875	11/11/85	1423Z	STRESSES URGENCY ERIM CCT ACQUISITION AND REQUESTS TIMETABLE
Sudan	Khartoum 16057	11/13/85	1316Z	GROUNDTRUTH SCHEDULE - TO BEGIN AT DAWN NOV 16 REGARDLESS
Sudan	State 348413	11/13/85	2230Z	ETAs ERIM STAFF LAURIN AND FERGUSON AND NOTE RE TM IMAGERY
Sudan	Khartoum 16090	11/14/85	0805Z	REQ RESPONSE Khartoum 15875 RE TM IMAGERY SCHEDULE
Sudan	Khartoum 16118	11/14/85	1203Z	REMINDER ON VISAS AND REQ RESPONSE ON OCTOBER TM IMAGERY
Sudan	Khartoum 16129	11/14/85	1232Z	DETAILS FOR ERIM ON NEEDED EQUIPMENT AND SITREP
Sudan	Khartoum 16199	11/15/85	1018Z	REQ RESPONSE Khartoum 16090 GROUNDTRUTH ETAs AND TM IMAGERY
Sudan	State 351180	11/15/85	1911Z	RESPONSE TO Khartoum 16199,16090,16129,16118 RE TM IMAGERY
Sudan	State 351653	11/15/85	2308Z	TRAVEL OF FEWS TRAINER RON SCHWARTZ ETA Khartoum 11/19 2015HR
Sudan	Khartoum 16319	11/18/85	1309Z	UNDERSCORES URGENCY CERTAIN TM SCENES; LAURIN/FERG. ARRD OK
Sudan	Khartoum 16257	11/18/85	1419Z	ADVISES HOLD SCHWARTZ TRAVEL PENDING EMBASSY CLEARANCE
Sudan	State 353455	11/18/85	2350Z	UPDATE ON IMAGERY (RESPONSE TO Khartoum 16319)
Sudan	State 353627	11/19/85	0050Z	ADVISES SCHWARTZ HOLDING IN PARIS PENDING EMBASSY CLEARANCE
Sudan	Khartoum 16479	11/20/85	1031Z	REGRETS EMBASSY STILL CANNOT CONCUR TRAVEL RON SCHWARTZ
Sudan	State 369045	12/04/85	1800Z	GIVES SELLMAN/LAURIN ETA 2220 HRS 12/17/85 LUFTHANZA 538
Sudan	Khartoum 17433	12/09/85	1521Z	GIVES CLEARANCE FOR SELLMAN AND LAURIN, ERIM TO TRAVEL DEC 17
Sudan	State 376049	12/10/85	2204Z	RPTS ON IMAGE PROCESSING AND PRESENTATION EQUIP. NEEDS
Sudan	State 380735	12/13/85	2338Z	IMMEDIATE REQUEST FOR EHB TRAVEL CLEARANCE ERIM/USDA
Sudan	Khartoum 17688	12/13/85	2338Z	APPROVAL FOR TRAVEL OF SELLMAN/LAURIN-ERIM & HALEY/BOYD-USDA
Sudan	Khartoum 17685	12/15/85	1354Z	EVIDENCE OF POOR CROP YIELDS IN EASTERN Sudan (TRADIT. FARMS)
Sudan	Khartoum 17932	12/19/85	1246Z	REQUESTS DR. GHOBRIAL & OTHER TWO SudanESE RETURN NLT DEC 22
Sudan	State 387612	12/20/85	2316Z	GIVES ETA 3 SudanESE PARTICIPANTS (GHOBRIAL, SULIMAN, AHMED)
Sudan	Khartoum 18094	12/23/85	1152Z	PROVIDES AUTH. TO AMEND TA'S SudanESE ADD'L 5 DAYS DOLS 400
Sudan	Rome 31890	12/27/85	1327Z	VERY POSITIVE REPORT ON Sudan CROP ESTIMATION PROJECT & FAO
Sudan	Khartoum 18223	12/29/85	1132Z	REPORTS ON SORGHUM/MILLET CROP ASSESSMENT USDA/ERIM & ACTION
Sudan	Khartoum 00919	01/22/86	0811Z	FEWS-SERISS; ADVISES NEED FOR DR NESTEL & REQ. LENGTH HER TDY
Sudan	State 029541	01/30/86	0816Z	ADVISES TULANE CONTRACT MAY BE EXTENDED & NESTEL AVAIL 1 YR
Sudan	Khartoum 04136	03/20/86	1252Z	THANKS FOR State 77826 AND REQUESTS IMAGERY BE SENT VIA APO
Sudan	State	03/21/86	1400A	REQUEST CLEARANCE FOR VISIT NANCY MOCK 2 WKS BEG O/A APRIL 1

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COUNTRY	CABLE	DATE	TIME	SUBSTANCE
Sudan	State	03/24/86	1500A	CONFIRMS IMAGERY SENT VIA APO TO E. MARTELLA
Sudan	Khartoum 04451	03/27/86	1328Z	SUGGESTS NANCY MOCK RESCHEDULE AFTER APRIL 21 DUE ELECTIONS
Sudan	State 110236	04/09/86	2052Z	ADVISES THAT IMAGERY BEING SENT AIRFREIGHT IN LIEU OF APO
Sudan	Khartoum 06354	05/01/86	0607Z	ADVISES NESTEL WILL STAY; TIME OF HIGH FEWS PRODUCTIVITY
Sudan	Khartoum 06464	05/04/86	0957Z	SERISS - CPE (REPORTS ON SudanESE ACTIONS ORGANIZE CPE) RRSC
Sudan	Khartoum 06665	05/08/86	1223Z	SERISS CPE GRANT 650-E-609 TO RRSC/NAIROBI - LANGUAGE
Sudan	State 148724	05/10/86	1023Z	REMOTE SENSING ACTIVITIES .1986 - CPE, MONITORING, SCRUITANIZG
Sudan	State 203578	06/27/86	1619Z	REQUESTS CLEARANCE FOR FELIX LEE VISIT
Sudan	State 214650	07/09/86	1633Z	Draft FEWS Country Report for July for Mission Comment
Sudan	State 393815	12/20/86	1708Z	ETA Wally Jansen (Terra Mar) 0530 Jan 1 via KLM 563
Sudan	State	12/24/86	1800A	Gives details 3 pcs hardware for Terra Mar GIS sent DHL
Sudan	Khartoum 16601	12/29/86	1228Z	Suggested text for January FEWS report
Sudan	State 011745	01/14/87	0728Z	Text of Jan FEWS report sent and comments from Eric for Penny
Sudan	Khartoum 02260	02/22/87	0525Z	Queries rel. of early warning Japanese-FAO EW link to SERISS
Sudan	Khartoum 02482	02/25/87	0519Z	Comments on FEWS in relevance in Sudan and Dakar PHA meeting
Sudan	State 075153	03/13/87	1800a	Requests concurrence FEWS team visit Mock/Usdin/Trayfors/etc
Sudan	Khartoum 03578	03/18/87	1323Z	Concurs FEWS visit Mock/Usdin/Trayfors/Rodenberg/Martorell
Sudan	Khartoum 04365	04/02/87	1424Z	Recommends Trayfors plus max. 1 other person come ahead
Sudan	Khartoum 04635	04/09/87	1552Z	SERISS Remote Sensing - requests PWA TA on Atlas training
Sudan	Khartoum 04660	04/10/87	1037Z	FEWS/Resource Base Monitoring Proposal to ARLove fm Koehring

ANNEX 3

The First *Generic* FEWS Database

An early attempt to develop a ***generic FEWS database*** grew out of discussions centered on **status indicators and geographic identifiers.** As there was then an ongoing crisis there was little time for careful planning and experimentation. Nor was there time to evaluate conditions in the field. The first FEWS database was developed around three topical areas: (1) demography; (2) health/nutrition; and (3) indications and warnings (of food stress). The first indicators used were the following:

ID Section:	Demography Section:	Health & Nutrition Section	Indications Warnings Section:
DATE	REFUGEES	DEATHS/DAY	STAPLES
ENTITY	DISPLACED	%<80%	D-ANIMALS
ID	RESIDENT	%<70%	F-ANIMALS
LAT	TOTAL	#DIAR/DAY	CREDIT
LONG	AR-REF	%BLOODY	SOCSERVICES
WSOURCE	AR-DISPL	%WATERY	INDIGENTS
WSUPPLY	AR-RESID	%SCURVY	MIGRATION
	AR-TOT	#MEASLES-2WKS	CLINICS
	AR%TOT	%MEASLES-VAC	CRIME
	AR%REF	VACPROG	IDATA-QUALITY
	AR%DISPL	MEASLES	NOTES
	AR%RESID	DPT	
	DATA-QUALITY	POLIO	
		TETANUS	
		MENING	
		#ORSPKTS	
		#USED-2WKS	
		SANPROG	
		SHELTER	
		STORAGE	
		P-ACCESS	
		HDATA-QUALITY	

These indicators were reflected in several databases and spreadsheets which followed.

As the project gained some experience, the FEWS generic database was encapsulated in the form of a *Knowledgeman* and later a *dBaseIII+* database developed at Tulane University by Felix Lee. This went through several modifications and was later abandoned as it was determined that FEWS database requirements were considerably more complex and more diversified than could be managed with a single database product.

SECTION 2.0 SPATIAL ANALYSIS TOOLS

In this chapter the use of spatial analysis tools and techniques within FEWS will be examined in contemporary, historical, and future perspectives. For many nontechnical persons, spatial analysis tools and, in particular, geographic information systems or GIS are difficult concepts to grasp. Because they are also among the most important and fundamental of FEWS elements, considerable effort is given here to examine the relevance – and potential – of advanced spatial analysis tools such as GIS.

2.1 DEFINITION OF SPATIAL ANALYSIS AND GIS IN THE CONTEXT OF FEWS

The mission of FEWS is to identify specific populations at risk of food insecurity and to do this as early as possible in order to give policymakers and administrators the broadest scope for formulating appropriate responses. From inception in 1985, FEWS has interpreted this mission as involving the identification of specific populations *at subnational level*, i.e., locating groups of people within and across administrative boundaries and national borders who are at risk of food insecurity. Completion of this mission, ipso facto, involves **spatial analysis** of some sort, and plotting or map-making to portray the results of that analysis.

It may be useful to trace the spectrum of spatial analysis tools and techniques from the very simple (lists and maps) to the more complex (GIS) in order to better understand what GIS really is and how its capabilities relate to the FEWS mission.

2.1.1 Spatial Analysis

Spatial analysis involves the distribution of a chosen data element or elements for study *geographically*, i.e., relating each datapoint to a specific geographic location. This can be done manually or through a series of automated and semi-automated techniques, working from original datasets. Imagine, for example, that it is desired to examine the residential distribution of A.I.D. employees. The office phone book would be sufficient to identify employees and their office locations, but considerable additional effort would be required to determine their residential locations. Once this had been done (resulting in a more detailed phone book, now giving home addresses as well as office addresses), it would be necessary to plot each residence address on a large-scale map of the metropolitan area. Clearly, this could be done by hand given sufficient time and determination. The result would be an annotated map showing A.I.D. employee residences.

The above would not constitute a GIS nor is it an automated system, although some automated techniques may have been used in developing the extended phone list. Our analysis could be carried further. We could, by overlaying additional datasets spatially, explore a number of dimensions relating to A.I.D. employees: how many live within five miles of a McDonald's; how many live within three miles of a hospital; how many are clustered in the Virginia suburbs vs. the Maryland

suburbs; whether those with young children are more likely to live in the suburbs than within the District; etc. We could compare changes over time if we had residence information for different years. All of this could be done manually, but clearly this would be tedious at best. Certain (limited) spatial analyses could also be done without plotting to a map. A.I.D. employees could be grouped and listed by zipcode or by home telephone prefix; both would give a pretty good notion of the area in which the employees lived, if not the **precise geographic location** of each employee. Similarly, grouping them by city, county, or state would yield progressively less-specific information. Whether or not this would be useful would depend on the purpose of the analysis, i.e., the underlying assumptions and object of the analysis.

Would these simple analyses be useful, even though they were accomplished manually? Of course they would...they'd be just about as useful as if they'd been done with an automated GIS. In fact, such analyses have been done for centuries and for just about every reason imaginable. In FEWS's early years, such analyses were done -- often with a greater degree of computerization than implied above -- because there was no other way available to analyze and portray the data.

2.1.2 GIS Defined

What, then, is the relevance of a geographic information system? Writing in 1978, Brooks and Pease of Oregon State University postulated that a GIS is "a computerized system designed to store, process, and analyze spatial data.[10]" They noted that GIS has been used for a variety of purposes, including land-use inventories, environmental impact studies, forest management, water resources management, agricultural surveys, and socio-economic studies. Brooks and Pease went on to say that the most significant difference between a GIS and other information systems is in the spatial or geographic nature of the data. Data must be geo-referenced, i.e., tied to locations on the surface of the earth.

The above definition is useful, but it doesn't go far enough. Our extended A.I.D. phone book, containing residence addresses and coded to latitude/longitude coordinates, put into any of a number of spreadsheets or databases would qualify under the 1978 definition. The data would be geo-referenced and could be stored, processed, and analyzed. However, it would not be practical to extract from the spreadsheets or databases information pertaining to the *intersection* of data layers, i.e., specific geographic boundaries within which multiple data layers overlap and, potentially, interact.

Among the many other published definitions[11] of GIS are the following:

- A system for capturing, storing, checking, manipulating, analyzing, and displaying data which are spatially referenced to the earth.

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[10] Brooks, Kris and Pease, James R., "Geographic Information Systems: A Review (Environmental Impact Assessment Project). Corvallis: Oregon State University Extension Service, May 1978, 60p

[11] Portions of this section were adapted from Sayeed Ahmed, "Geographic Information Systems: A Global Technology", *The Daily Star*, Dhaka, 4 May 1994.

- Any manual or computer set of procedures used to store and manipulate geographically referenced data.

- An information technology which stores, analyzes, and displays both spatial and nonspatial data.

- A special case of information systems where the database consists of observations on spatially distributed features, activities, or events which are definable in space as points, lines, or areas. A GIS manipulates data about these points, lines, and areas to retrieve data for ad hoc queries and analyses.

- A database system in which most of the data are spatially indexed, and upon which a set of procedures are operated in order to answer queries about spatial entities in the database.

- An automated set of functions that provides professionals with advanced capabilities for the storage, retrieval, manipulation, and display of geographically located data.

- A powerful set of tools for collecting, storing, retrieving at will, transforming, and displaying spatial data from the real world.

- A decision support system involving the integration of spatially referenced data in a problem-solving environment.

- A form of MIS (management information system) that allows map display of the general information.

While all the above definitions differ somewhat, a common thread running through them is the use of geographically referenced data. Geographical features such as administrative boundaries, physical features (e.g., lakes and rivers, elevations), and locations of infrastructure (e.g., roads, rail lines, hospitals) are defined within a GIS as areas, lines, and points.

Within FEWS, GIS use involves most or all of the elements noted above. As a sophisticated spatial analysis tool, GIS is used within FEWS to answer questions having to do with **location, condition, trend, routing, pattern, and modeling**, e.g.,

QUESTION TYPE	EXAMPLES
Location	What is the population at a given location?
Condition	Where are all the locations having current vegetative stress?
Trend	What has changed over time? How does the current situation compare to that of the last five years?
Routing	What is the best way to reach a food distribution point? Where should such points be located?
Pattern	What is the pattern of cereal price increases?
Modeling	What will happen to crops in X area if rains abate early?

Given the background above, a working definition of GIS might go as follows:

> *A GIS is a computerized decision-support tool which uses geographically-referenced data to assist in analysis and decisionmaking. This tool can store and manipulate several data layers, each layer representing a separate physical, political/administrative, infrastructure, or other thematic data type. It can also provide output showing the intersection of these data layers, sometimes highlighting relationships which were previously unrecognized.*

This definition more closely resembles the general concept of GIS as applied within the FEWS project. Note that there are several important concepts, including wo new ones not previously mentioned:

- computerized tool using geo-referenced data
- *decision-support tool*
- can manipulate several data layers
- can provide output showing intersection of various layers
- *can highlight relationships not previously recognized.*

Each of these five GIS concepts requires a bit more explanation.

2.1.2.1 Computerized Tool Using Geo-Referenced Data

Several modern, PC-based GIS packages are now available. Some of these are described in a later section. All have in common the ability to ingest geo-referenced data, to store and manipulate these data, and to provide some sort of output of both the base data and the results of analyses.

GIS is considered to be a field-based as well as a U.S.-based tool within the FEWS project; it must therefore be compatible with PC-class machines used in the field. GIS packages which require specialized hardware, or will run only on workstations, minicomputers or mainframes have also been used by FEWS since 1985. The USGS/EDC provides certain products to FEWS which are developed or refined using specialized hardware/software. In general, these products are intended to be compatible with PC-based GIS packages such as PC Arc Info or Atlas GIS.

2.1.2.2 Decision-Support Tool

The above working definition of GIS explicitly includes the dimension of *decision-support*, flagging the important concept that GIS is -- or should be -- a tool used to facilitate real-world decisionmaking. In fact, GIS *is* being used in this way in a variety of disciplines. The National Technical Information System (NTIS) currently lists 402 papers focusing on geographic information systems. A sampling of their titles reveals that GIS is being extensively used for a wide variety of decision-support functions, including:

- disaster mitigation
- soil moisture analysis
- emergency management
- evaluating urban environments
- military land management
- water quality monitoring
- routing gas pipelines
- crop simulation modeling
- modeling of arid watersheds
- resource management decisionmaking
- hydrologic investigation
- transportation management
- forest damage assessment
- landslide hazard mapping
- deep-ocean exploration
- lunar mapping
- forest pest management
- coastal zone management
- fuelwood planting site selection
- radioactive waste repository siting

..... and dozens of other uses.

In FEWS, GIS is increasingly being used as a decision-support tool to: (a) help FEWS analysts make more confident judgments (decisions) about the data they are working with; and (b) provide more detailed and more reliable analyses upon which program decisionmaking can be based. Specific examples of GIS and other spatial analysis techniques being used in FEWS are given below.

2.1.2.3 Manipulation/Intersection of Multiple Data Layers

A modern GIS can work with multiple data layers, allowing diverse datasets to be overlaid in order to show intersections of data themes. For example, data layers could include:

- physical and administrative boundaries
- roads, rivers, lakes
- zoning: commercial, farming, residential, park & recreational
- soil types
- average rainfall
- livestock
- nutritional status
- health infrastructure
- market prices for key foodgrains
- vegetative vigor, etc.

A modern GIS is able to "overlay" these and other datasets in order to elicit their interrelationships. Such overlay capacity can be used to model relationships, e.g., overlaying soil type with topological, hydrological, and rainfall data, to determine soil erosion potential and to estimate soil loss run-off. Note that use of a GIS no more guarantees a good analysis than use of a word processor guarantees a good report or a good book. **The quality of the product depends upon many factors. Most important among these is the underlying concept and the thematic structure and relationships.** You can't take a lousy idea and generate a wonderful book with a computerized word processor any more than you can throw geo-referenced data layers willy-nilly into a computerized GIS and expect a wonderful analysis to result. The whole process must begin with a well thought-out conceptual model. This seems obvious and hardly worth saying, yet it is all too easy to lose sight of because of the intense work involved in "caring for and feeding" a modern GIS (see later section on Practical Issues in GIS Implementation).

2.1.2.4 New Relationships

While use of a GIS will not guarantee new insights, it WILL often provide them, given that the proper conditions have been met in advance. These involve choosing the right datasets to overlay (based on an underlying set of assumptions and a conceptual model) and an alert analyst adept at manipulating datasets. Meeting these conditions is non-trivial. Quite apart from the rigorous thinking which must take place in advance, there is a staggering array of options. There are often a number of datasets to choose from. Many datasets involve **time-series** data; one needs to choose which times to include (and why). Some datasets involve **point data** (e.g., market prices), but assumptions often must be made concerning how point data can be generalized over a specific geographic area or throughout a specific population. Many existing FEWS datasets are not geo-coded or are not in a form which can easily or directly be imported to the GIS software. Decisions must be made concerning the importance of these data to the analysis at hand, and whether or not to expend the time required to convert these datasets. Once these conditions are met, however, GIS provides a marvelous tool which optimizes the chances of identifying new relationships, much as an electronic spreadsheet provides the financial planner with a wonderful tool for asking "what if" kinds of questions and for playing out a number of scenarios. A GIS can be asked, "show me all the places where crop failure appears imminent AND where crops failed last year AND where grain prices are

rising AND where young males are being sent to the cities...etc., etc.". The ability of a modern GIS to respond almost immediately to such queries and to display the resultant analysis on a color screen or printout provides a potent tool for the analyst bent on exploring a variety of relationships. The speed of response almost guarantees that the analyst will pose additional questions, apply different conditions, and may well discover new relationships and new directions for enquiry. This type of "interactive analysis" would be virtually impossible to implement manually.

2.2 GIS IMPLEMENTATION TO DATE WITHIN FEWS

2.2.1 Background

Implementation of GIS technology requires an appropriate mix of hardware, software, human resource, database, and conceptual/analytical inputs (see Figure 2.1). With 20/20 hindsight, it can be argued that only since 1992-1993 has it been possible and practical to integrate GIS technology broadly throughout FEWS.

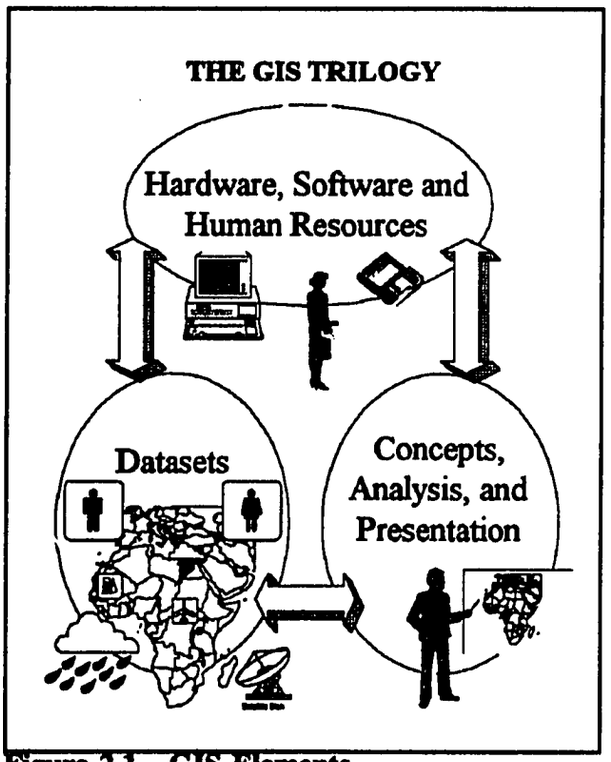

Figure 2.1 - GIS Elements

GIS has played an important role, however, since FEWS' inception. One of the first FEWS contracts (fall of 1985) was with a local engineering firm, Greenhorn and O'Mara, to obtain advice and recommendations on GIS implementation. G&O recommended FEWS consider an ***Intergraph*** system, requiring expensive specialized hardware and software. Because of its cost and lack of portability, however, FEWS decided not to follow this recommendation. Soon after, the FEWS analysis contractor, Price-Williams Associates (PWA), began to experiment with a system known as ***Terra Mar*** which was implemented on then state-of-the-art microcomputers (286's with specially-designed parallel processing boards for Terra Mar software). The learning curve on this system was very steep, and it used a UTM coordinate system with 6-degree increments that was inconvenient for FEWS datasets. GIS technology as ported to microcomputers was evolving rapidly. A very successful GIS on minicomputers and mainframes, ***Arc Info***, was announced in several modules for microcomputers. Since this was the system used by the USGS/EDC, it appeared that ***PC Arc Info*** would be a product suitable for general use in FEWS. In the event, this proved not to be so for a variety of reasons. The software modules were released very slowly; they were buggy; the then state-of-the-art microcomputers were really not powerful enough to run the software efficiently; the software was not user-friendly; etc.

Frustrated in their efforts to fully implement GIS technology in a microcomputer environment, FEWS turned to other spatial analysis and display solutions for general use in Washington and in the field. They weren't GIS but they were nonetheless crucial to getting the spatial analysis job done. Even so, FEWS was pushing the technological limits of what could then be done in a microcomputer environment.[12] During FEWS I, the PWA analysts attempted to use a software package called ***MapInfo***, but it was rejected as inappropriate to FEWS needs. ***AtlasAmp***, the forerunner to ***Atlas Graphics***, was then tried in conjunction with ***MapEdit***, which was the data-input module or digitizing package. By July 1986, the PWA analysts used a combination of ***AtlasAmp*** and ***ProDesign***. As software packages were upgraded, the names changed to ***Atlas Graphics*** and ***DesignCad***. ***Atlas Graphics*** became the popular workhorse for producing FEWS maps. By late 1987, maps were developed in ***PC ArcInfo*** and exported to ***DesignCad***; new information was developed primarily in ***Atlas Graphics*** or in ***PC ArcInfo***, and then converted to the CAD package overlay with the base map.

As time went by, microcomputer technology began to evolve very rapidly with more powerful platforms becoming available at shorter and shorter intervals. GIS software packages also were evolving. By the time the Intel 486-class microcomputers came into general use (the first 486s were introduced into FEWS at the end of 1992), two powerful, PC-based GIS software packages had become available: ***Idrisi*** and ***Atlas GIS***. Finally, it seemed, both the hardware and software pieces of the GIS puzzle were in place. In January 1992, a full-time GIS specialist was recruited for the Washington office. He worked to develop new GIS applications, test software, and support field-based GIS operations (through TDYs and E-mail). Training in ***Idrisi*** was given to FFRs at the Reading workshop in April 1992, and the FFRs in Chad and Burkina started to use ***Atlas GIS*** shortly thereafter. In the fall of 1993 intensive training was given to all FFRs in the use of ***Atlas GIS***, the package believed to be most appropriate for general use in the field. The training involved exercises using FEWS data. FFR acceptance and enthusiasm was high. For many, including those who had struggled with GIS concepts for years, this was the first time GIS became a real possibility.

2.2.2 Hardware Requirements

Modern GIS software will run very well on the current 486-class microcomputers. As with most complex software, the faster the microprocessor the better. Memory requirements are not exceptional (these are DOS-based packages)[13], though 8 to 16mb of RAM is preferred. A fixed storage capacity of 300-500mb is desirable, keeping in mind that the computers used for GIS applications in the field are also used for all other applications: data managers, spreadsheets, word processing,

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[12] Throughout the FEWS project, USGS/EDC has continued to provide GIS products and services, using larger computers and sophisticated digitizing, display, and plotting devices. These have been very helpful in a variety of situations. However, the cost and time delays associated with this type of GIS work have somewhat limited the more extensive use of USGS/EDC's GIS services.

[13] A Windows-based version of Atlas GIS is being tested in FEWS in June 1994. Undoubtedly, GIS packages of the future will increasingly migrate towards Windows and other GUI-based platforms (NT, OS/2, Chicago, NextStep, etc.).

graphing/mapping, E-mail, etc. The new Pentium and Power PC processors will further increase the speed of analysis, making more complex analysis tasks possible. The new microprocessors will also have the horsepower to handle powerful new operating systems such as Windows 4.x and NT, providing a graphical user interface (GUI) to all software. Client/server applications will undoubtedly provide network solutions to GIS implementation.

All GIS packages have the ability to produce graphical output using patterns and/or colors to delineate areas and points of interest. A color printer or plotter is therefore desirable to produce hard copy. All FFRs have the necessary equipment to produce color maps of good quality. Indeed, approximately 40% of the thematic maps are now produced in the field, another 40% are produced by FEWS/W, and 20% are produced by USGS/EDC, (in contrast to the first years of FEWS in which maps were produced mainly in the U.S.).

2.2.3 Software Requirements

Many FEWS requirements for GIS can be met through the use of ***Atlas GIS*** (Strategic Mapping Corp., $1,030 per copy plus $595 for data import/export program). This is a full-featured GIS package which is vector-based. FEWS currently has 11 copies operational in the field plus three at the Washington office. Trimestral maps are required to be done in the field in a GIS environment (usually, using ***Atlas GIS***). Consolidated (regional) trimestral maps are done in Washington.

All FFRs also have the GIS package, ***Idrisi*** (Clark University, $320 per copy). This is a raster-based GIS package useful for manipulating maps represented in a grid cell structure. ***Idrisi*** is also used in the Washington office and at USGS/EDC.

Three copies of ***PC Arc Info*** (ESRI Corp., $4,995 per copy) are also in use, two in Washington and one in Zimbabwe. This is also a vector-based, full-featured GIS package. Its' continued use is related to maintaining the link with USGS/EDC, and some special functionality which is not available with other packages. Sharing of data between ***Atlas GIS*** and ***PC Arc Info*** is either very easy or quite difficult, depending upon the database in question.

2.2.4 Human Resource Requirements

Experience has demonstrated that a bare minimum of five days training in the use of any one of the above packages is required for FFRs without previous GIS experience. Insofar as possible, training should be built around real-life models and examples directly related to vulnerability analysis. Additionally, periodic technical support is required particularly in areas of data coding, data

conversion, and in developing application models. As GIS use becomes more pervasive in the developing countries, GIS support groups are forming and GIS trained and experienced personnel are becoming more available.

These developments will support FEWS use of GIS in several ways:

- increasing availability of skilled personnel for data entry/file conversion;
- increasing availability of support groups for a range of technical issues; and
- increasing availability of GIS-compatible datasets in country.

Basemap Layers

The creation of uniform basemap layers for use in each FEWS country is much more complex than one would imagine. In FEWS I and early in FEWS II, a comprehensive worldwide digital dataset named *World Database II (WDBII)* was developed by the Central Intelligence Agency and was made available for general civilian use. USGS/EDC converted *WDBII* for use by FEWS in the Sahel-Sudanian region. *WDBII* included national boundaries, roads and rivers, second-level administrative boundaries (equivalent to U.S. states), and a few other data layers. However, FEWS analysis often takes place at the 3rd administrative level (county) or below. The digitizing of Admin levels 3 and 4 was done in the U.S., either at PWA or USGS/EDC. In addition, PWA provided some Admin 2 layers, where the *WDBII* was out-of-date. In 1993, a new worldwide dataset, *Digital Chart of the World (DCW)* became available. It is superior in several ways to the earlier *WDBII*, and USGS/EDC decided to convert to the new system. *DCW* is available on CD-ROM in formats for *PC Arc Info* and *Atlas GIS*; USGS/EDC has the *Arc Info* version. The new worldwide dataset is not directly compatible with either the *WDBII* files or with the more detailed boundary files. An effort is already underway to incorporate those key layers of the *DCW* database likely to be most useful to FEWS. Further, it will be necessary to "rubber-sheet" existing detailed boundary files in each country to interface with the new *DCW* files. Basemap layers should probably consist of: (a) administrative boundaries; (b) roads; (c) rivers; (d) railroads; (e) elevations; (f) towns; and (g) lakes.

2.2.5 Database Requirements

All data destined to be used as a thematic layer in a GIS-based analysis must be geo-coded (point, line, or area) and must be in a format directly compatible with the GIS software being used. This is easy enough to write and to understand conceptually, but often extremely time consuming (see discussion under Practical Issues section). Since its inception in 1985, the FEWS project has done a monumental job in opening up new data streams needed for analysis, and in making good use of these data streams for early warning purposes. In most countries digitized maps were nonexistent and had to be created by FEWS. Multi-sectoral, time-series databases were developed in each FEWS country, providing a solid base on which to build current and future analyses. The scope and depth of FEWS databases is without parallel in the A.I.D. world. However, and with notable exceptions,[14] much of the attribute data contained in the FEWS historical database developed over the past eight years or so

[14] For example, the entire AVHRR and Meteosat imagery database; geographic boundary files; many attribute datasets in Zimbabwe, Burkina, Niger, etc., are notable exceptions.

is not presently fully GIS-integrated. A concerted effort is ongoing at FEWS/W and USGS/EDC to provide basemap layers for all FEWS countries ASAP, as well as to prioritize existing datasets for conversion. USGS/EDC is also giving attention to those data managers that currently do not provide output directly compatible with GIS formatting. Wherever possible, options for such output need to be built into the data managers.

2.2.6 Conceptual, Analytic and Presentation Requirements

As previously noted, proper utilization of GIS is dependent upon a good conceptual construct: one cannot just overlay random thematic data layers and expect something useful to result. Rather, the overlay of thematic data layers should follow a well thought-out plan for interrelating two or more datasets to support or refute a previously formulated hypothesis. Given the high-cost of converting historical datasets and of constructing new ones for GIS treatment, the need for rigorous thinking in advance becomes even more important.

Presentation of the results of GIS analysis can be as straightforward as producing a single annotated map, or may involve a series of maps, charts, tables, text, and other products. Often, as A.I.D., host-government, and NGO "clients" become more familiar with the capabilities of a GIS, demands mount for special analyses to be done which may or may not be directly related to the objectives of the FEWS project. Responding to these requests often entails considerable data processing. FFRs and FEWS analysts and managers must therefore find ways of developing presentations easily adaptable for multiple audiences, while continuing to concentrate on the mainstream work of FEWS.

Typical GIS Presentation Examples. In November 1992, FEWS published an analytical paper in association with the Ministry of Public Service, Labour, and Social Welfare, Government of Zimbabwe. The paper "Towards the Development of a Methodology for Food Aid Targeting in Zimbabwe" presented the results of an analysis of vulnerability of populations at the sub-district level. A joint workshop was held in Harare presenting the results of the assessment (including a series of maps produced by GIS), and focused on the use of such analyses for targeting food aid in the country. Indicators of vulnerability for this assessment (GIS layers) included population density, live birth weight, livestock per hectare, cash crop production, per capita cereal crop production, and drought-resistant cereals. Two of the many such maps produced are shown below in Figures 2.2 and 2.3, illustrating results plotted to the national and provincial levels. As can be seen, these maps provide a clear representation of the geographic distribution of vulnerability at the national and provincial levels (Fig. 2.2) and at the sub-district level (Fig. 2.3). Spatial analysis techniques are routinely used in FEWS Bulletins issued every 10 days during the growing season. An example is shown in Figure 2.4. A typical FEWS map is shown in Figure 2.5.

FIGURE 2.2
Country and Provincial Level Analysis

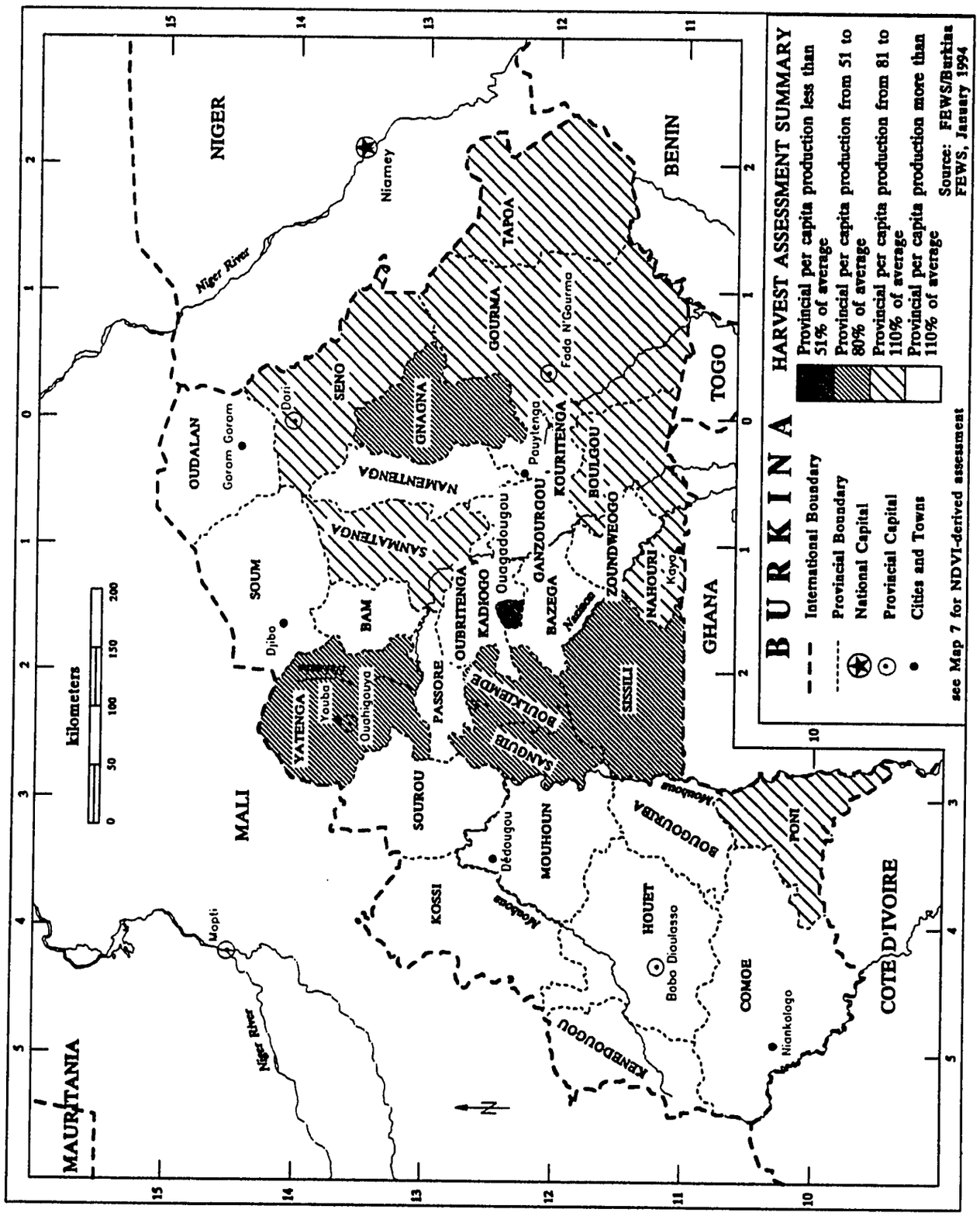
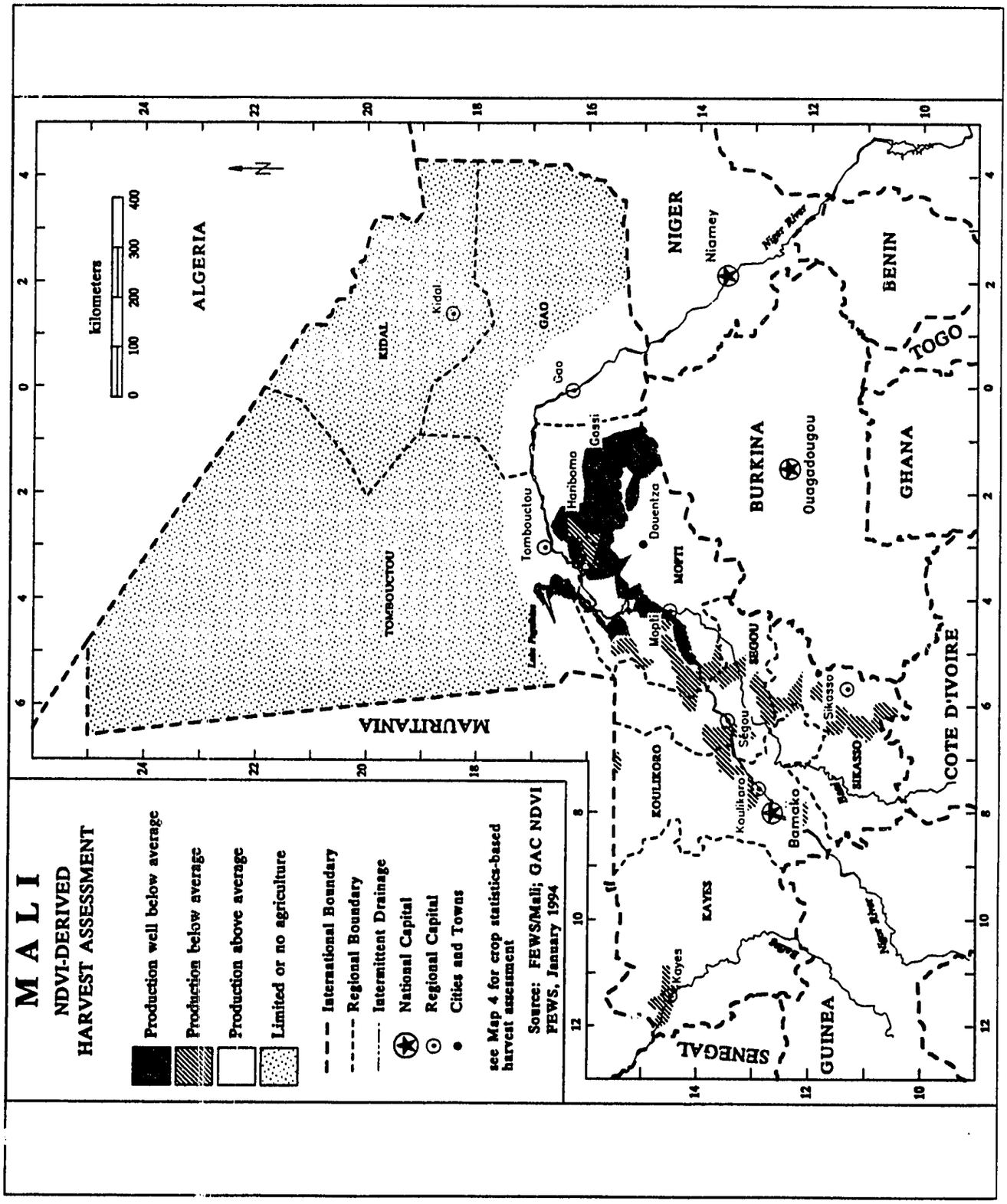


FIGURE 2.3
Provincial and Sub-district Level Analysis



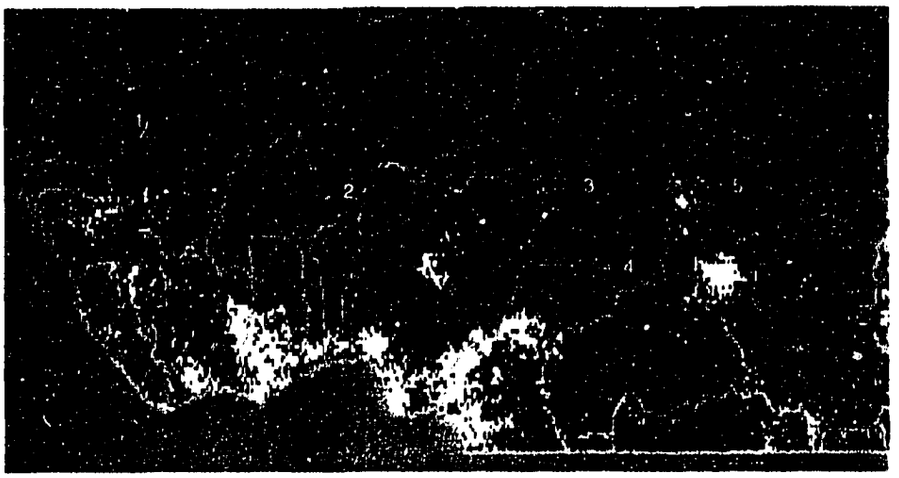
FEWS BULLETIN

A.I.D. Famine Early Warning System

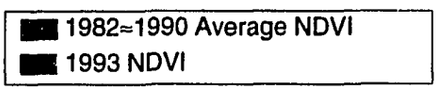
August 20, 1993
No. 9/93

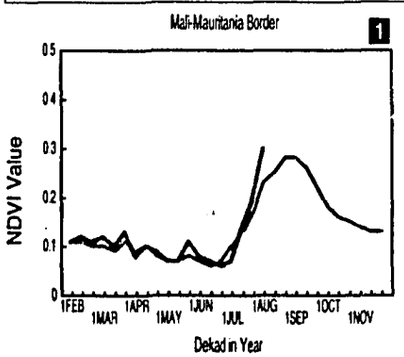
1993 Regional Vegetative Season Progressing Well

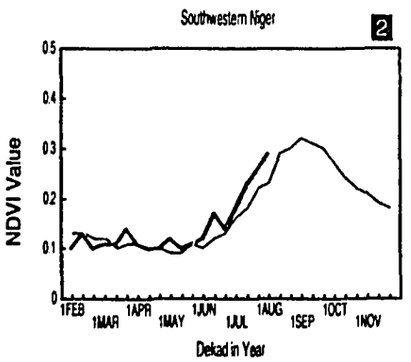
The 1993 vegetative season appears to be progressing well across most of the Sahel and into Ethiopia. There are isolated areas of concern where continued monitoring is necessary. Additional sources of information relating to timing of rainfall and agricultural activities, commodity prices, and other country specific information provide some insight on the potential of the agricultural season, as distinct from the vegetative season. Figure 1 shows the NOAA/NASA GAC Normalized Difference Vegetation Index (NDVI), for early August expressed as a deviation from the 1982-90 average. Green areas indicate, for 1-10 August 1993, above average conditions while red areas signify below average conditions, and grey areas indicate cloud cover. Comparable images for recent dekads (10 day intervals) show fairly consistent results of near- or above-average levels. The line graphs present more detail for specific locations, giving NDVI values from 1 February through 10 August 1993 against the 82-90 average for February through November. Data presented for the locations in Mali/Mauritania, southwestern Niger, and southeastern Chad extends the results presented in FEWS Bulletin 6/93. The strong early start (see FEWS Bulletin 4/93) is still evident in southeastern Chad, where June values were some 4 dekads ahead of normal. A similar, though reduced in magnitude, above-average seasonal progression can be seen in the graphs for southwestern Niger and the Mali/Mauritanian border. In contrast, the graphs for central Chad and west-central Sudan highlight two areas where vegetative conditions have run below normal for the last three or more dekads. These are areas where additional information is being sought. Additional information is also needed in the better than average 'green' areas of the image. The FEWS 'convergence of evidence' approach serves to delineate areas where the current vegetative picture may be good, but specific agricultural problems exist. This includes locust damage, areas of water stress, or where ground conditions were too wet for normal agricultural practices.

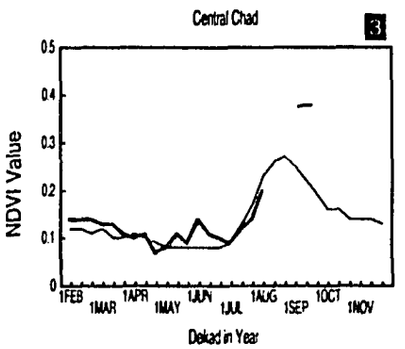


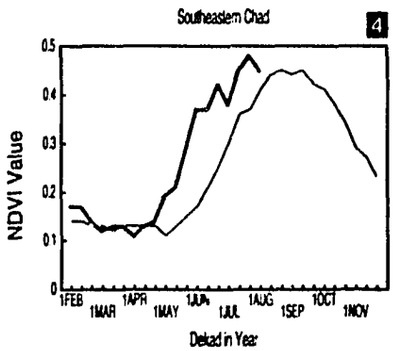
1. Mali-Mauritanian Border
2. Southwestern Niger
3. Central Chad
4. Southeastern Chad
5. West-Central Sudan

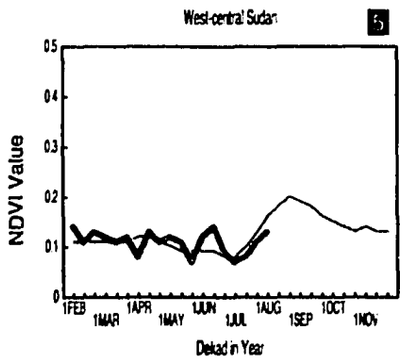












SUDAN Roads to be Improved

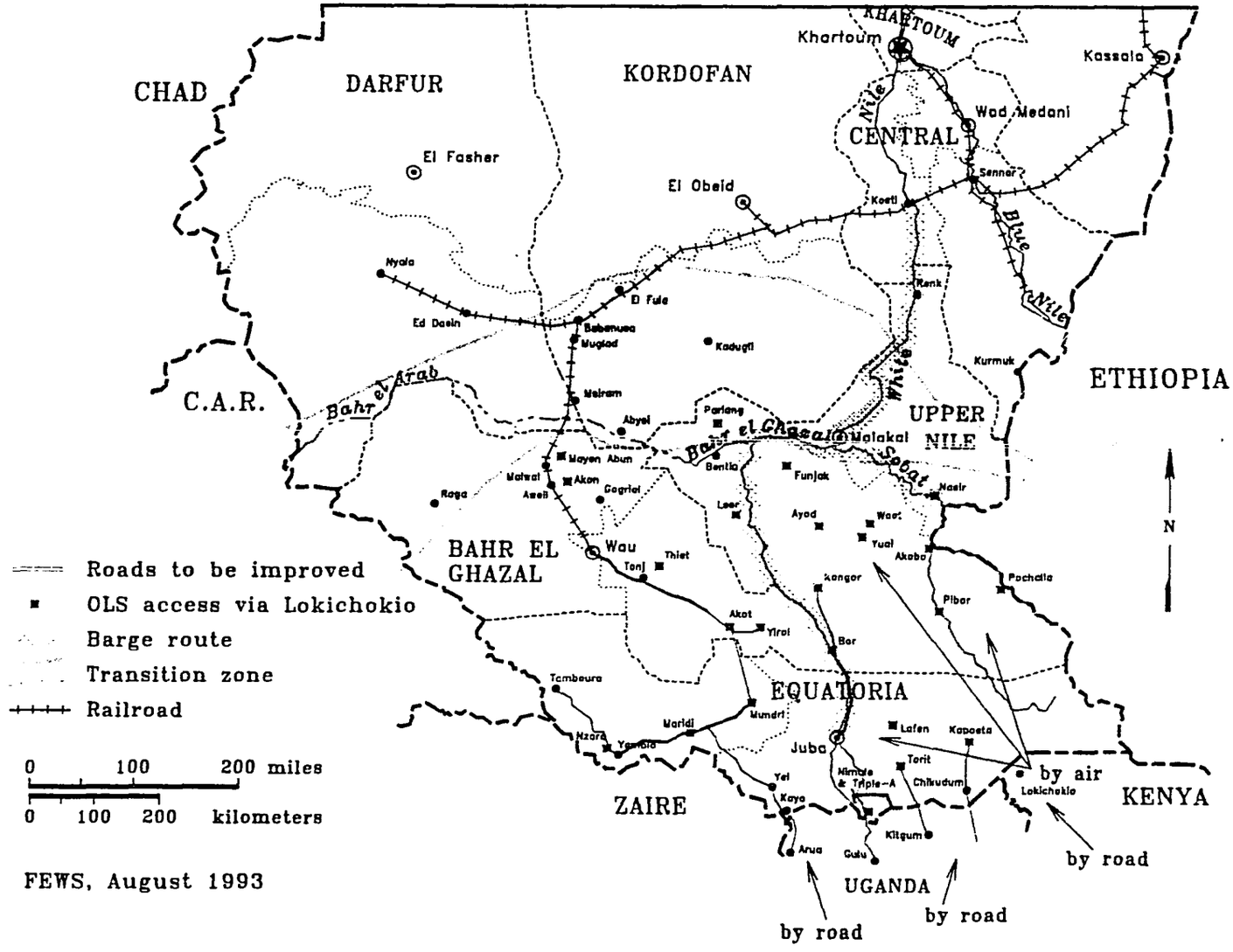


FIGURE 2.5
Sudan Situational Analysis

2.3 SATELLITE IMAGERY IN FEWS

2.3.1. Role of Imagery, History, and Present Use

Imagery derived from satellite sensors is a special case of spatial analysis within the FEWS project. Imagery is important because it is the only type of synoptic data ("all encompassing") available to FEWS on a regular basis. Collected regularly over time, and processed and stored in a standardized manner, imagery becomes a key analytical tool depicting short and long-term trends over extended geographic areas.

Almost from its first days, FEWS began exploring the potential use of various forms of satellite imagery for early warning purposes. Among the potential satellites were: METEOSAT (the weather satellites which produce relatively low resolution images such as those seen on TV weather broadcasts); the Advanced Very High Resolution Radiometer (AVHRR) which collects data in several spectral bands at resolutions up to one kilometer; Landsat which provides higher resolution images (up to 30-meter resolution) in seven spectral bands and, later Spot, the French-designed satellite which can provide color images to 20-meter resolution and black and white images to 10-meters[15].

Together with the USGS/EDC, NOAA, NASA, and the Foreign Agriculture Service of the USDA, FEWS experimented with these imaging platforms to see how they could be made useful for famine early warning. There were a number of technical and operational questions to be answered. The most fundamental of these were:

(1) Which types of satellite imagery can be useful in famine early warning? How is this imagery to be used, specifically?

(2) Which satellites can provide the needed imagery on a one-time, periodic, or continuous basis? With what frequency can imagery be collected, processed, and made available for FEWS analysis?

(3) What costs are associated with each type of imagery?

(4) Can the needed imagery be efficiently analyzed and displayed on PC-class microcomputers?

Obtaining satisfactory answers to these questions was a non-trivial undertaking. Answers were extracted only with painstaking research and experimentation over much of FEWS I and into FEWS II. Participants in this work included many persons from the above-named organizations,

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[15] Resolution refers roughly to the geographic size of a single grid-cell value (or pixel value) of the satellite's sensor. For example, in the LAC mode the AVHRR's sensor has a one-kilometer resolution, meaning that it collects a unique value in each spectral band for every square kilometer on the ground.

as well as others such as the University of Reading, the UNFAO, and scientists from a number of earth sciences and remote sensing disciplines.

The results of this work can be briefly summarized as answers to the above questions, as follows:

(1) **Types of Imagery.** Most remote sensing data can be useful for EW purposes. However, the most useful are:

(a) AVHRR-derived NDVI[16] data for "greenness monitoring";
(b) METEOSAT-derived CCD[17] data for estimating rainfall; and
(c) LANDSAT Thematic Mapper (TM)[18] data for special mapping and estimation purposes only (e.g., cropped area analysis in Sudan, soils classification, etc.).

LANDSAT data, even in the less expensive MSS form, was found not to be useful for monitoring purposes because of its high cost and its 17-day periodicity.

SPOT data could possibly be useful in high-priority, carefully delimited situations (its relatively high resolution comes at a very high acquisition, processing, and analysis cost).

(2) **Frequency.** AVHRR and METEOSAT data are collected daily and are aggregated into dekadal (10-day) form. They are processed and archived respectively by NASA and the University of Reading. FAO now shares the cost of this data source with FEWS. Imagery products are received by FEWS/W every 10 days and are distributed electronically to FFRs in the field (usually thru FEWSNET).

(3) **Cost.** FEWS has, through design and experimentation, settled on a combination of imagery products which represent the most monitoring capacity for a relatively low cost. Costs have been reduced through selection of products and frequencies, and through cost sharing with other interested parties (such as FAO). The more expensive imagery products (such as those derived from LANDSAT) have been used very sparingly and for special purposes such as establishing Crop Use Intensity (CUI) overlays for FEWS countries.

(4) **PC-Platforms.** In 1986, a FEWS staffer in Washington set out to develop a computer program which would run on a PC (then, 286-class machines were "state of the art") and which could assist FEWS analysts in displaying and analyzing satellite imagery. His first product, called Image Display and Analysis (IDA) succeeded beyond all expectations: IDA has become a widely acclaimed and accepted program both within FEWS and in the

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[16] NDVI = Normalized Difference in Vegetation Index

[17] CCD = Cold Cloud Duration

[18] The LANDSAT satellite collects two types of data: TM @ 30-meter resolution and MSS @ 80-meter resolution.

larger development and remote sensing communities. Over the years IDA has undergone a series of revisions to improve its usability and functions (another revision is now underway). In addition to IDA, GIS packages such as Idrisi are now available and capable of manipulating imagery on PC-class machines.

2.3.2 FEWS-Developed Software for Imagery Analysis

The FEWS project has found creative and innovative ways to use satellite imagery, both in its analysis and in the ways in which the results of analysis can be interpreted and presented to general audiences. This latter function is key to helping managers, decisionmakers, and other interested individuals to achieve a useful (working) knowledge and understanding of sometimes quite complex phenomena. Three FEWS-developed tools are important in this context.

As noted above, IDA was developed and introduced early in FEWS I. It continues to be the centerpiece product for displaying and analyzing imagery used in the FEWS project. More recently, other companion products have been developed and introduced for general FEWS use. IDA and two related products, SPACEMAN and VAST, are briefly described below.

2.3.2.1 IDA

The Image Display and Analysis (IDA) system was developed as a low-cost, easy-to-use satellite image display system to run on PC platforms. This system is designed to bring single-band or processed images out of the research laboratory and into the hands of analysts and decision-makers. This development coincides with efforts to make the satellite images themselves more readily available to these same people. These efforts herald the coming-of-age of remote sensing, and a growing understanding and acceptance of the use of satellite images throughout the world.

IDA was originally developed under contract to USAID for FEWS. The most current release was jointly funded by three organizations; namely USAID in support of FEWS, UNFAO in support of their ARTEMIS project, and USGS/EDC in support of their work with CILSS/AGRHYMET. This joint funding is an example of how donor agencies that share common goals can work together to achieve those goals more efficiently than would otherwise be possible.

The IDA program is "in the public domain". This means that it is available and is free to anyone. Current users are encouraged to make copies of the software and the manual and provide them to others. Copies are available from the FEWS Project, but it is perfectly acceptable to receive a copy from another IDA user. You are encouraged to register with the FEWS Project so that you can be added to the list of people to be notified of upgrades.

The IDA system is most often used for regional analysis and monitoring of vegetation and weather conditions. Vegetation conditions are monitored with normalized difference vegetation index (NDVI) images created from the AVHRR sensor on board the National Oceanic and

Atmospheric Administration's (NOAA) satellites. Weather conditions are monitored with Cold Cloud Duration (CCD) and Rainfall Estimate (RFE) images derived from METEOSAT data. Analysis of other single-band images and other raster datasets is possible.

IDA Systems Compatibility. As software systems become larger, it becomes increasingly difficult and less desirable for one package to "do everything". IDA addresses just the basic tools for image display and analysis. IDA data files are in formats either compatible with, or easily convertible to other systems which are already well suited to their particular tasks. The following is a partial list of other systems with which IDA and its files are regularly used:

PIZAZZ™ and DR. HALO™
These are used to capture the screen and print hard-copy color and black-and-white pictures.

SHOWPARTNER™/FX™
These are used to capture and edit screens, and to make slide shows.

PC-PAINTBRUSH™
Screens can be saved in PCX format for editing in PC-PAINTBRUSH.

ATLAS GRAPHICS™/ATLAS DRAW™/ATLAS GIS™
IDA maps are in the external ASCII file format (".bna" map files) used by these packages.

pcARC/INFO™
IDA map files can be translated to pcARC/INFO with the ARCATLAS command.

LOTUS™/QUATTRO™/EXCEL™
IDA's ASCII stats and raster files can be imported into spreadsheets.

ERDAS™
IDA supplies conversion routines to/from ERDAS images.

IDRISI™
IDA supplies conversion routines to/from IDRISI images.

SURFER™
IDA supplies conversion routines to/from SURFER .GRD, .BLN and .PLT files.

IDA Functions and Documentation. IDA's Quick Menu contains five commands (Main, Display, Process, Files, Batch). There are a total of 95 commands (functions) located in submenus. Together, these provide the analyst with a powerful set of functions to display, analyze, and output imagery products.

IDA version 4.02 is available in PKZIP-ed form (402kb). In unzipped form its files total 815k, including a 53-page manual (in both ASCII and Word Perfect 5.0 form). English and French menus are included. A revised version is under development.

2.3.2.2 SPACEMAN

The Spatial Data Management and Analysis Program (SPACEMAN) was developed by the FEWS FFR in Chad. It works together with IDA to extract statistics from NDVI or Meteosat images for special analysis. Its principal functions are contained in the Main Menu:

1. **Extract statistics** from images (NDVI or Meteosat);
2. **Analytic Graphics** (one or more regions, one statistic; one or more statistics, one region; mixed NDVI/Meteosat graph for one region; mixed NDVI/Meteosat graphs for all regions; or Intra-year analysis);
3. **Report Tables** (Dekadal Report, Monthly Report, or Seasonal Report).

SPACEMAN is used primarily to monitor the growing season. NDVI images show one dekad at a time. SPACEMAN graphs show NDVI of any given location as a time-series curve. This can be used to compare the temporal development of biomass to any one given year, or to the average of a range of years. This allows the reader to appreciate the temporal aspect of biomass development.

SPACEMAN is bilingual (English/French) and works with data at various administrative levels chosen by the user (e.g., admin. level 3). The user can choose any of 15 countries in the Sahel-Sudano region or Eastern & Southern Africa, or perform regional analyses.

SPACEMAN is written in dBase IV and is a very snappy performer. Its menus and user interface are very "user-friendly". SPACEMAN is available in PK-zipped form (223k). In unzipped form its files total 487k including _IDA.EXE.

2.3.2.2 VAST and VAST2

The Vegetation Analysis in Space and Time (VAST) program was developed in 1993 by the same FEWS FFR who developed SPACEMAN (now assigned as FFR/Mali). An updated version, VAST2, was released in December 1993.

VAST grew from the perceived need to develop a more focused analysis of NDVI data for agricultural monitoring, especially to track NDVI changes throughout the growing season and to synchronize the analysis with the timing of the growing seasons (rather than simply using calendar dates or dekads). VAST has been extensively tested in Chad and Mali. It produces results which match field reports and knowledge from other sources. Its application elsewhere will take some testing and calibration.

VAST is used to examine certain characteristics of the annual NDVI curve. For example, the start-of-season (SDAT) in a given year can be compared to the average SDAT over a number of years to determine early or late start. A late start will flag the region for close monitoring. FEWS/Burkina has used PVAL and CUMM to investigate the quality of the season. Both variables have been shown to be correlated with cereal production. The long-term variability (coefficient of variation) of MAX and CUMM are used in FEWS Vulnerability Assessment as indicators of agricultural risk. The length of season is another indicator used in the FEWS VA to assess the possibility/probability of agricultural activity and of crop diversity.

VAST Functions and Products:

- VAST analyzes NDVI time-series, using pixel-level data. It produces spatial images in IDA format.

- VAST produces 10 different products, all in IDA image format. These products and their associated lookup tables are as follows:

PRODUCT	LOOKUP TABLE (LUT)
1. SDAT	dekad.lut / month.lut
2. SVAL	def_img.lut or alternative
3. PEAK	dekad.lut / month.lut
4. PVAL	def_img.lut or alternative
5. HORZ	dekad.lut / month.lut
6. VERT	vertical.lut
7. AREA	vertical.lut
8. SLOPE	vertical.lut
9. DROP	vertical.lut
10. EVAL	def_img.lut or alternative

These 10 products may then be used in association with IDA. In IDA they may be displayed, processed, and printed.

VAST2 includes four new products: SKEW, C060, C090, and C120. It also does automatic smoothing of images (three-period smoothing with cloud masking)[19], processes only one year at

[19] Smoothing is desirable because of occasional wide variations in pixel values resulting from atmospheric interference and other physical factors.

a time (no more multiple years...these can be handled in batch mode), calculates true cumulative from start to peak, seeks true peak, and has several new user-defined options.

Specifically, the 14 VAST2 products are:

SDAT	Season Starting dekad
SVAL	NDVI value at SDAT
PEAK	Dekad with Maximum NDVI value
PVAL	NDVI value at PEAK
HORZ	Time between SDAT and PEAK in dekad (Length of veg season)
VERT	Difference PVAL - SVAL
CUMM	Cumulative NDVI from SDAT to PEAK
SLOP	Slope from {SDAT,SVAL} to {PEAK,PVAL}
EVAL	NDVI at 4 dekads after peak
DROP	Slope from {PEAK,PVAL} to {PEAK+4,EVAL}
SKEW	End-of-season SKEW index
C060	Cumulative NDVI from SDAT to 60 days after
C090	Cumulative NDVI from SDAT to 90 days after
C120	Cumulative NDVI from SDAT to 120 days after

VAST is available in PK-zipped form (69kb), including training notes. In unzipped form, its files occupy 179kb. A user manual for this product is currently under development.

2.4 PRACTICAL ISSUES IN GIS IMPLEMENTATION

2.4.1 Dataset-Related Issues

In order to be useful in a GIS environment, principal FEWS databases must be developed or converted into the proper formats for import. For *point data*, this could be as straightforward as adding two additional data items to each record: LAT for latitude and LON for longitude. For example, an existing list of Ministry of Health hospitals, health posts, and dispensaries could be converted for GIS use by appending to each entry its geographic coordinates (LAT/LON). The method of *determining LAT/LON*, may be as straightforward as referring to a gazzeteer, or may involve considerable research, including possible field work[20].

For area data, including administrative boundaries, the problem is not so straightforward. Areas (discrete polygons) are identified by *placename* and by *unique code*, e.g., Arlington County might be described by the placename ARLINGTON and the code "ARL04". Often, both are required to discriminate among places having the same name, e.g., Arlington, VA and Arlington, TX.

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[20] While not yet in universal use, portable GPS units (such as the Garmin 50) are now priced under $400 and may soon be helpful in determining LAT/LON coordinates for some FEWS point data.

While many existing FEWS datasets have such placenames and codes, these may differ from, e.g., placenames and codes used in the *Digital Chart of the World (DCW)* data layers. In turn, *DCW* placenames and codes often vary considerably from official placenames and codes used in each country. These discrepancies in placenames and in codes must be resolved in each instance where it is desired to import an existing dataset into a GIS environment.

Another problem, alluded to in an earlier section, has to do with the *registration of digital data* to some chart projection standard. This is a highly complex problem, the resolution of which is best left to highly skilled mapping experts (such as those employed at USGS/EDC). Suffice it to say here that in order for discrete data layers to be integrated in a GIS environment, the layers must be registered to the same standard (i.e., vertically and horizontally integrated). This often involves converting from one type of map projection to another as well as "rubber sheeting", the process of "pulling or stretching" vector data in one data layer so as to mate with vector data contained in a second data layer. In layman's terms, this can perhaps be understood as ensuring that boundaries (international, administrative, rivers, roads, etc.) coincide amongst the various data layers in use.

2.4.2 Data Format Issues

There are two general types of data which one might wish to overlay in a GIS environment: **raster data** and **vector data**. Raster data results from a grid cell approach to measurement in which a geographic area is overlayed by a grid, and a value is assigned to each cell within that grid. The most common type of raster data used in FEWS is that derived from satellite imagery. Vector data consists of line, point, or area (polygon) values, and covers a very wide range of thematic types, including geographic features, administrative boundaries, physical infrastructure, and attribute data such as population density, market prices, and nutritional status.

In practice, FEWS uses **both raster and vector data**, and there is a corresponding need for GIS and other software tools capable of handling both types. For satellite-derived (raster) data, most analyses are done with a FEWS-developed tool known as IDA (Image Display and Analysis), a specialized tool which is now widely accepted and used throughout the development community. If, however, it is desired to use satellite data in a GIS environment in order to overlay other types of data, several problems result. Both *Atlas GIS* and *PC Arc Info* are **vector-based** GIS packages; neither can directly handle **raster data**. *Idrisi*, being **raster-based**, can handle satellite imagery as well as **vector data** (it can do some conversions of raster-to-vector and vector-to-raster).[21] However, *Idrisi* lacks many of the analytical, presentation, and human interface qualities which are valued by FEWS analysts and which are present in *Atlas GIS*. Another FEWS-developed product, *Spaceman*, was designed to put extracted data (from *IDA*) into dBase format from which Harvard Graphics graphs are made. Once extracted, these values (originally

[21] Coding and data integration is required before any vector-to-raster or raster-to-vector transfers can occur.

from imagery) can also be imported into a vector-based GIS package such as *Atlas GIS* where they can be manipulated along with other (vector-based) thematic datasets.

2.4.3 Theoretical and Conceptual Issues

Problems of **data acquisition, accuracy, integrity, and interpretation** are ever present. While these are not specific to GIS use, they impact significantly upon how datasets should be used in a GIS environment. It may be helpful to think of two sets of problems:

(a) those pertaining to the *content and meaning* of the individual datasets; and

(b) those pertaining to the manner in which individual datasets are *integrated* in a GIS environment.

With respect to (a) above, what do low birthweights in a particular location at a particular time really mean? Or falling grain prices? Or an increase in out-migration? Assuming the AVHRR satellite sensor is actually measuring photo-synthetic activity (generally thought to mean "overall vegetative vigor" or "greenness") within the 7-square kilometer "pixels[22]" used for FEWS analysis, does this necessarily reflect the state of cropping on the ground?

The FEWS analyst deals with these types of questions on a daily basis and, in time, becomes quite skilled at the mental interpolations required. To undertake an analysis of individual datasets or layers in a GIS environment requires that the analyst go further: he/she must construct an hypothesis which encompasses the *interrelationships* between and among the various datasets under analysis.

2.5 RELEVANCE OF GIS TO FEWS

By the close of 1993, following the intensive training given FFRs in Atlas GIS at the Nairobi workshop in October, there was a wide consensus that GIS is *important* to their work. Most expressed the intention to integrate GIS into their daily work as quickly as possible.[23] Exactly how this will be done will vary somewhat among the FFRs, since each is facing a unique situation in terms of data availability and format, GIS support groups within country, and other

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[22] Technically, the AVHRR GAC data collected by the satellite is at 4-km resolution. It is sampled and registered by NASA for FEWS, resulting in an effective 7-km resolution.

[23] Some FFRs had previously been using the GIS program, Idrisi in their work. All had been doing spatial analysis using whatever tools and methods were available to them. Nevertheless, the Nairobi workshop, which also included the integration of IDA and Idrisi derived data to AGIS, represented a GIS milestone of sorts in that it resulted in an enthusiastic acceptance of what was perceived to be a practical GIS tool for general use in the field.

controlling factors. In Zimbabwe, where more GIS-compatible databases are available than elsewhere[24], GIS integration will mean that all new datasets, and appendages or corrections to existing ones, will be developed to be directly GIS-compatible. This entails some extra work up front, but the payoff in terms of enhanced analytical potential is judged by the FFRs and other FEWS personnel as being more than worthwhile. In other FEWS countries, integration will entail some mix of converting old databases while developing new ones for full GIS compatibility. Some countries (Burkina, Mali, Chad) already have a number of GIS and GIS-like applications and, thus, may be presumed to have a head-start on GIS integration. Newer FEWS countries (Zambia, Malawi, Kenya) are still substantially involved in early data collection and data source development activities. How fast they will be able to move will be largely dependent on the shaping of new datasets and the availability of GIS support personnel for data coding and conversion, and for formulation of specific models suitable for testing in a GIS environment.

2.5.1 Types of Spatial Analyses

Exactly how GIS will be used in future FEWS analyses remains to be seen. As stated earlier, the range of possibilities is staggering. However, the following listing may provide a glimpse into the future by looking at what has already been done in terms of spatial analyses. As mentioned above, spatial analyses have been conducted by FEWS since 1985. Here is a sampling of some more recent analyses, some of which were done in a GIS environment:

- current NDVI values were used to produce indications of local crop potential on the basis of the analysis of historical relationships between NDVI and spatially disaggregated crop production data;

- NDVI values were used to estimate the quantity of pasture biomass production by region and compare that to disaggregated estimates of livestock populations to determine future herd prospects;

- combined measures of access to roads (road buffers) and distance from health care facilities (point buffers) were used as a proxy indicator of health care access;

- estimates were made of the population in specific market zones delineated by Thiessen polygons constructed from point-specific market locations;

- population density was estimated by region according to soil types;

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[24] A USGS/EDC GIS specialist has been in Zimbabwe for almost two years. Much of his time has been devoted to coding and converting existing datasets so that they may be used in a GIS environment. This is slow, labor-intensive work, but is now virtually complete.

- crop use intensity classifications (CUI) was used to examine the impact of anomalous NDVI on agricultural areas;

- CUI data were used to spatially disaggregate estimates of crop production, in order to calculate local agricultural incomes and food deficits at the sub-administrative level;

- a range of vulnerability indicators, geo-referenced to production system classes were combined to derive overall vulnerability levels; overlays of population and demographic data are also used to estimate the number of people in each vulnerability category;

- the inter-regional distribution of income was estimated from gold mine production according to the distance of regions from each mine;

- NDVI data were used to estimate the start, end, and length of growing season and to identify at-risk areas according to sequential non-increases in NDVI values for areas at 7-square kilometer resolution (used to draw implications for local crop production);

- Meteosat imagery was used to detect probable mid- or late-season gaps in rainfall during crucial periods of the crop cycle (to draw implications for future crop production);

- NDVI and Meteosat pixel data were summarized for analysis of vegetative vigor and estimated rainfall, respectively, according to established political boundaries.

2.5.2 The Promise of GIS

FEWS staff are currently investigating the use of GIS technology to answer a number of important questions, among them:

- how can the growing season best be monitored?

- how can GIS best be used to improve vulnerability assessments?

- how can FEWS data layers be fully integrated using GIS technology?

The promise of GIS is largely in its potential to convert *data* into ***useful information.*** The report of the March 1993 FFR Workshop in Mombasa explains this very well:

> ***Much of what GIS technology has to offer the project is perhaps best understood by first considering the fundamental distinction between "data" and "information". Data is generally thought of as observations about the world represented by words and figures. Information, on the other hand, is usually understood to be a higher-order derivative of data: data with meaning. The distinction is analogous to the FEWS database where***

abundant data exists in discrete layers of vulnerability indicators. A more comprehensive and systematic use of technology for integrating multiple geographic themes (layers) has yet to be realized. The challenge remains to derive more information from the data.

The same report noted the "generally accepted conclusion that constructing and geo-coding a significant GIS database has been a primary constraint to creating fully integrated GIS analytical models..."

In sum, it would seem that both theoretically and practically, GIS is important to FEWS work. Some argue that further enhancement of the FEWS methodology is dependent upon GIS integration. Full integration and exploitation of GIS potential, however, will be dependent upon resources committed.

2.6 THE FUTURE OF SPATIAL ANALYSIS: FEWS III AND "BEYOND FEWS"

As of this writing (May 1994) it is unclear how the next iteration of FEWS will be structured, either conceptually or organizationally. There appears to be some sentiment within A.I.D. for expanding the scope (i.e., the number of countries included) of FEWS. Continuing budgetary pressures make it unlikely that any such expansion in scope would be accompanied by an expansion in funding. If this proves to be the case, it follows that radical changes would be required in project organization, staffing, and methodology. These cannot be predicted at this time.

It seems likely that whatever changes are made to FEWS, the central purpose of *identifying populations at risk of famine and food insecurity* will remain. If so, spatial analysis tools and techniques will of necessity be employed...how else are populations to be identified and located? The role of advanced tools such as GIS would seem logically to be a function of project goals vs. project resources. Questions of accuracy, confidence, and credibility must be dealt with in the equation. A related question concerns the use of GIS for A.I.D. purposes other than FEWS. This is a concept...perhaps a dream...harbored by persons associated with the FEWS project for several years. Their thinking goes like this:

In countries where FEWS has been active, it has developed the most comprehensive interdisciplinary datasets available. Many of these datasets involve time-series observations (useful for trend analysis). While these datasets were developed for the purpose of vulnerability analysis, the potential for their use in other development-related activities is enormous. To the extent that GIS can be used as a decision-support tool, can it therefore not be used -- in association with the extensive FEWS database -- in a decision-support capacity for A.I.D.'s work in population/family planning, in agriculture, in human resource development, etc.?

Many persons who have considered this question are convinced that the answer is YES.

SECTION 3.0 DATA MANAGERS & ASSOCIATED TOOLS

The software tools known as "data managers" support the achievement of FEWS objectives which are to strengthen the early warning capacity in A.I.D.; improve the early warning capacity of host country governments; and promote a common approach to early warning at the international level. The improved data management and analysis capability afforded by the data managers helps in at least three ways: (1) it promotes a prompt, efficient, and more extensive analysis of incoming data; (2) when these software tools are disseminated to interested parties in host governments they will, theoretically, improve and enhance in-country early warning capabilities; and (3) by facilitating the sharing of information management and analysis technologies, and through feedback from users, better products can be developed to meet the international community's needs. This chapter explores the data managers and associated tools utilized to carry out FEWS mandate.

Previous to the development of the FEWS database managers, data were archived and manipulated through use of a variety of software packages. During the early stages of the FEWS project, LOTUS spreadsheets, as well as specially-designed database programs[25] were used. FFRs and Washington-based analysts developed their own databases using primarily dBase and LOTUS, or other software available to them. While these methods of storage and manipulation proved adequate for the short-term, each database was compartmentalized, serving the particular needs of an analyst or FFR. What was needed was a means for archiving the voluminous amount of data, and the ability to access these data for analysis and for cross-country comparisons. It was argued that "a sectoral FEWS data manager" would provide analysts and FFRs of disparate technical backgrounds the fundamental analytical skills of a given discipline by providing a set of basic automated procedures which a professional analyst in that discipline would use. Common analytical routines could be incorporated directly into the data manager. In addition, the use of such tools would enable the maintenance of pertinent data in a common format across countries, facilitating cross-country comparisons and regional analyses. In reality, the data managers developed for FEWS II[26] have the following properties:

- they allow FEWS field and US-based staff to implement repetitive analyses on a large amount of historical and current data;

- they provide a canned set of analyses for non-specialists in four disciplines (meteorology, agricultural production, agricultural economics, and demography);

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[25] These were written in Condor 3, dBase II, Knowledgeman, et. al.

[26] REDATAM+ is an off-the-shelf demographic software developed under U.N. auspices. While it is used by some FFRs and FEWS/W staff, it was not developed by the FEWS project.

- they are easy to use;

- they transfer expertise from sectoral specialists to FEWS analysts and FFRs.

A series of data managers were planned to cover the most used and most data-rich areas including rainfall (RAINMAN), agricultural statistics (AGMAN), demographics (REDATAM-PLUS), and market prices (PRIX). Following discussions with organizations outside of FEWS, it became clear that these database management tools were of interest to a wider range of potential users. In the same way that the IDA package was developed specifically for the FEWS project under an earlier phase, and has since been widely distributed, it is hoped that the data managers described below also will prove to be useful for the international early warning and related communities.

3.1 RAINMAN

Designed by FEWS and produced by USGS/EDC, RAINMAN was developed as the first of a number of data managers for FEWS II. As the name suggests, RAINMAN is intended for the storage, management, retrieval, and analysis of rainfall data for FEWS. Usually collected from the host country's meteorological or hydrology services, the database contains historical as well as the most current rainfall information. As close to being real-time interactive as possible, RAINMAN enables FEWS analysts to view the progress of a season within the current year and it's degree of normality, as compared to historical reference periods. RAINMAN provides consistency in two ways: (1) congruity in analysis (RAINMAN can be thought of as a "mini-expert system" which captures the essence of certain rainfall analyses); and (2) a standardization of products from each country giving added value because of their comparability and completeness. RAINMAN output products include tables, graphs and exportable subsets of the database that may be viewed on screen, captured in files, or printed as hardcopy.

3.1.1 History of RAINMAN

As with most FEWS' tools and products, RAINMAN has undergone a progression of changes. The challenge of implementing RAINMAN raised choices among many alternative approaches. Initially, the policy which guided the development of the overall FEWS package was to use commercial software where possible for the rapid development of analytical capability, and to use customized development only to expedite data-flow between software packages. The first prototype of RAINMAN was developed as a series of LOTUS macros. However, the growing accumulation of data soon led to memory limitations, and the clumsiness of manipulating such large datasets in a spreadsheet environment necessitated that the data and functional capabilities be transferred to a database manager, first to dBase in 1990, and then to RUNTIME in 1991.

Several beta versions of RAINMAN were released for testing. Version 1.0 was circulated in August 1991; version 1.5 was first demonstrated to FEWS personnel in December 1991. The

upgrade included an alternative to LOTUS graphics, the ability to use cross-calendar year seasons, and interchangeability for different data sets. Following a FEWS review, version 1.63 was released in April 1992. This version permitted the overwriting of data in the database, and increased the flexibility of analytical routines.

Orientation and style changed somewhat over time as the focus shifted to a package suited for use on microcomputers in the field. The debate running throughout RAINMAN's development was whether the product was for FEWS' use only, or for other organizations (like IDA, which has found very good acceptance and use in other organizations)[27]. This discussion was relevant in regard to two factors: computer platforms likely to be employed; and, given the initial guidelines, whether or not the program should be proprietary (i.e., completely written by USGS/EDC, including sophisticated graphing routines), or should be made to work with other commercial packages which, like IDA, would require additional software expenditures by users.

In the winter of 1992-93, a major rewrite of RAINMAN was done jointly by USGS/EDC and FEWS field personnel. RAINMAN was moved from dBase RUNTIME applications to compiled C and dBase applications operating from a single database with no pre-calculated database files of percentiles, averages, etc. This was done to improve the speed and looks of both the input and the output routines, and to provide the user with more concise error messages, lending a greater user-friendliness to the package. In May 1993, RAINMAN was converted to a program written completely in C++. The resultant package was introduced into the field in June 1993 in two regional sessions (Sahel/Horn and Eastern/Southern Africa). This process was very positive and has resulted in the use of RAINMAN by the FFRs.

3.1.2 Relevance to FEWS Work

RAINMAN serves the important function of organizing, analyzing, and presenting rainfall data in ways which help the analyst to better calibrate data derived from other sources, e.g., NDVI and anecdotal reports. It is thus an important tool supporting the FEWS "convergence of evidence" analytical approach.

3.1.3 Organization of Data

Stored and accessed as dBase (*.dbf) files, rainfall data are organized into dekads, or 10-day intervals. The calendar month is divided into three periods: Dekad 1 covers days 1-10, Dekad 2 covers days 11-20, and Dekad 3 covers days 21 to the end of the month. While rainfall data are collected in a variety of ways, i.e., daily, weekly, monthly, dekadal data are used for several reasons. Dekadal data are collected in most of the FEWS-monitored countries and are used in the Sahelian Agrhymet program (Agrhymet is a regional agricultural and hydro-meteorological

[27] IDA was originally created with only FEWS in-house use in mind.

facility of CILSS, the Permanent Interstate Committee in the Struggle Against Desertification in the Sahel). Five FEWS countries lie within the CILSS region. Dekadal data give a usable resolution of the progression of the rainy season, and a general "fit" for agricultural activities. In addition, dekadal rainfall data are at the same *time resolution* as the "greenness" products, the NDVI or normalized difference vegetation index. NDVI data are used extensively by the FEWS project, and are also aggregated in 10-day "dekads".

RAINMAN's database management routines are designed to run from user-defined parameters, which delimit a season window, and can be adjusted to specific country situations. This window can be defined in increments of one dekad, beginning in dekad 1, 2, or 3 of a given month and similarly ending in dekad 1, 2, or 3 of a subsequent month. Cross-calendar year seasons are also supported.

Pre-defined station definitions, station sets, and station codes are resident in RAINMAN. However, the software allows the user to add to each of the files, as well as to define group stations. RAINMAN is comprised of five different data files:

- **Station Definitions** are used to add details of new stations to the database, or to modify details of a station already present. Details include: name, latitude, longitude, altitude, and a number of user-defined station codes. Latitude and longitude are in degrees and minutes. Altitude can be given in any unit as long as it is consistent throughout the database. Data identifying reporting station location are included for GIS mapping, image data overlay, and any spatially oriented graphic production.

- **Station Sets** are user-defined groupings of stations, intended to facilitate subsequent, repetitive analysis. For example, the user may wish to define a particular grouping from a drought-prone area which will be tracked over a number of dekads.

- **Station Codes** are user-defined numbering schemes that allow for the unique identification of stations. Station codes can come from a variety of sources including the local meteorological service, regional organizations such as AGRHYMET, or Southern Africa Development Council (SADC), and international bodies such as the World Meteorological Organization.

- **Rainfall Data - Interactive** is the route to interactive data entry screens. The user first defines which stations and years are to be updated, then pressing the `data entry' option, a series of station-year screens appear on which the user can input data.

- **Rainfall Data - File Import** allows the user to import an ASCII file containing station codes, dekad date, and rainfall amounts. Data are ordered with one line per dekad, containing station code, year, month, dekad, rainfall amount and source code.

RAINMAN makes a distinction between active, saved and new databases. The active database is that which is up-to-date, in the data subdirectory, and is currently being worked on. A saved database is one which has been active but has been saved at some point in time. This operation compresses the data files and places them in a subdirectory called HOLD in the user-defined RAINMAN data subdirectory. A new database defines one where either an empty structure is created, or where the user is inputing data from an external source, such as from a neighboring country.

3.1.3.1 Data Analysis/Products Generated

Five general types of analyses and outputs are available in RAINMAN: (1) Deviation From Normal; (2) Dekadal Rainfall vs. Percentiles; (3) Cumulative Rainfall vs. Percentiles; (4) Percentile Envelope; and (5) Tabular Output. These options include the ability to do **multivariate display** to the screen to a plotter file, i.e., to visually examine analyses for one or multiple rain-gauge stations simultaneously.

Rain stations and years are selected for analysis; up to five years can be chosen. Cumulative curves for chosen years and for up to three reference periods are generated, and can be color-coded by the user. Output can be to a screen or to an HPGL (plotter) file. Analytical products can be viewed individually or multiply, meaning several or many graphs on the screen simultaneously.

Display of a large number of stations simultaneously can be used to gain a general impression of rainfall conditions. Once the user has a general overview, subsets consisting of selected stations can be chosen for further analysis.

HPGL files can be used for plotting to a pen plotter. Colors and line types are user-defined (dependent on the characteristics of the individual plotter), or imported to a WordPerfect or other word processing document, if desired. Principal use in FEWS is to produce these products using a 6 pen plotter.

Deviation from Normal. Using this option, RAINMAN displays cumulative rainfall totals expressed as deviations from normal (user-defined primary reference periods) for a specified year and for specified stations.

Dekadal Rainfall vs. Percentiles. Whereas multiple station analysis allows users to compare a number of sites on one screen, several suboptions allow a more detailed look at individual stations. For example, dekadal rainfall totals for a chosen year can be graphed individually by station, including three percentile curves. Graphical output is determined by the availability of LOTUS. If LOTUS is available, the chosen dataset is loaded automatically and the worksheet appears on screen. Graphs are produced automatically for each location name by invoking a

LOTUS macro (ALT-G) after highlighting the desired station. If LOTUS is not present, internal RAINMAN routines will produce a graph for viewing or output to a HPGL file, but no user customization is possible.

Cumulative Rainfall vs. Percentiles. RAINMAN allows, for any year with data, production of a graph of cumulative rainfall through a season, set against user-selected percentile curves. This type of output helps the user to define "good" or "poor" progression of the season. Type of output, again, is dependent on the availability of LOTUS.

Percentile Envelope. The percentile envelope is a way of estimating what form the rest of the rainy season may take, thus helping to define "good" and "bad" scenarios. It is important to note that these are not *predictions* or *prognostications*, rather they are possible scenarios.

Data Contouring. This option prepares one of several parameters for the SURFER package (version 4.13 and earlier). Output is then used for analysis and presentation in conjunction with SURFER software.

Tabular Output. This option allows the user to investigate cumulative rainfall totals for any defined part of the year, and for any year in the database. Output is in the form of tables. Sample outputs from RAINMAN are shown in Table 3.1 and Figure 3.1 below.

3.1.4 Hardware and Software Requirements

RAINMAN requires certain minimum hardware and software to operate:

- 80286/386/486 processor with corresponding math coprocessor;
- VGA graphics card and color monitor;
- high-density disk drive for installation, either 5.25 or 3.5;
- 640K of RAM expanded to 1 Megabyte;
- 6 megabytes of hard disk for the four subdirectories (2Mb reserved for data);
- DOS version 3.3 or higher.

Four high density diskettes are supplied for the installation of RAINMAN. During the process of installation, RAINMAN will check for sufficient space on the computer. RAINMAN will also ask the installer for the location, if present, of LOTUS 3.0 and SURFER. In the absence of LOTUS, RAINMAN will automatically invoke internal graphics routines. In the absence of SURFER, automatic contouring will not be available to the user.

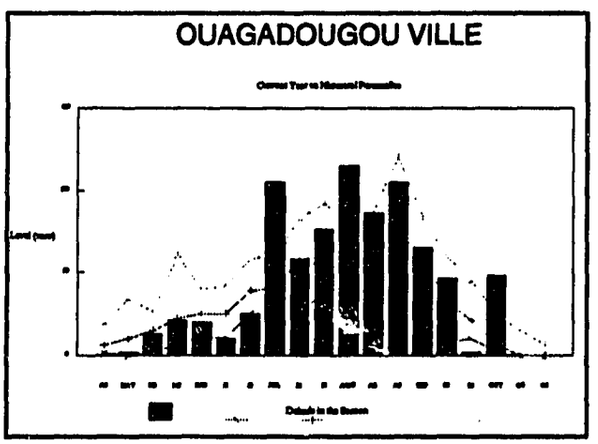
TABLE 3.1

SAMPLE OUTPUT FROM RAINMAN

BURKINA FASO - YEAR: 1990
SEASON DEFINITION: APR3 TO OCT3; 19 DEKADS
AVCUM: 1968 TO 1987
AVCUM2: 1961 TO 1990
AVCUM3: 1981 TO 1984

Station	VALID	CUM	AVCUM	AVCUM2	AVCUM3
BOBO-DIOULASSO	19/19	957.0	958.9	978.5	862.4
GAOUA	19/19	918.6	950.3	962.2	791.8
KOUPELA	19/19	630.2	698.1	748.6	582.5
LEO	19/19	713.1	885.9	892.5	752.5
OUAGADOUGOU VILLE	19/19	121.5	752.1	753.8	656.6
OUAHIGOUYA	19/19	403.1	544.9	592.6	482.8
TENKODOGO	19/19	634.2	774.9	795.5	704.8

FIGURE 3.1
SAMPLE OUTPUT FROM RAINMAN



3.2 AGMAN

AGMAN is an agricultural database manager designed to facilitate the archiving, analysis, and presentation of agricultural production data. AGMAN's capabilities include the organization and storage of agricultural production statistics for any given reporting unit (location), crop, or time period. AGMAN output products include tables and graphs that may be viewed on screen, captured in files, or printed as hardcopy. Although originally designed for the FEWS project, AGMAN is public domain software and can be freely distributed.

3.2.1 History of AGMAN

The specific functional requirements for AGMAN were developed by a FEWS/W and a USGS/EDC staffperson in November 1991. In December 1991, the first example screens and menus of AGMAN, written in the C programming language, were demonstrated at the FEWS workshop in Morocco. This demonstration showed the performance increases and flexibility of the database. The first product described in the functional database requirements document was demonstrated at a FEWS workshop in Reading, England in the spring of 1992. By this time, all data entry routines had been completed, and the focus was on product generation. FFRs were given a copy of the software along with data for their respective countries.

A demonstration version of AGMAN was given at the March 1993 workshop in Mombasa. This version was incomplete in that the software was not in full compliance with all the specific functional requirements. Based on the experience of writing RAINMAN in the C programming language, a major user-interface update on AGMAN, as well as fixing some "bugs" was done to improve the stability of the software. In August 1993, AGMAN version 2.0, along with data for each country was released and distributed to the FFRs as a beta test. Two regional training sessions, in Harare and Niamey, were held to aid the FFRs in learning the software. Based on the FFRs comments, an updated version of AGMAN has been produced and is currently being reviewed in FEWS/W.

3.2.2 Relevance to FEWS Work

Food production data are key to the analysis of food security. AGMAN provides a convenient tool for organizing such data in a standardized way within and across FEWS countries. It also supports standardized analyses on both historical and current-year data. AGMAN's contribution to the FEWS "convergence of evidence" analytical approach is also important, since agricultural production data can be compared with, e.g., NDVI and rainfall data, market price data, anecdotal reports, and other types of related information to arrive at a more complete understanding of situational factors in a given location.

3.2.3 Organization of Data

Stored and accessed as dBase files, agricultural production data are arranged by location, commodity, and time period. Pre-defined locations, commodities, seasons, and harvests are resident in AGMAN. However, the software allows the user to add or modify each of the files. AGMAN is comprised of five different data files:

- **Location** is defined as the base-level reporting unit for which agricultural production data are collected. These reporting units represent geographic areas such as administrative units, agricultural regions, and project areas. They may also represent production sectors such as "irrigated" or "traditional" agriculture. Simple locations may be aggregated into composite locations for additional processing, and may be included in more than one composite location. Composites may aggregate simple locations or other composite locations. An example of a composite location is "southern Burkina" containing all simple locations in the southern part of that country.

- **Commodity** refers to a specific crop such as wheat or millet. Simple commodities may be aggregated to form composite commodities. For example, barley, maize, rice, and millet may be aggregated to create a commodity called "cereal grains". Simple commodities may be included in more than one composite; composite commodities may aggregate simple or composite commodities. Each commodity has a loss percentage associated with it for computing net harvest from gross production amounts. Loss percentage is defined as the percentage of the commodity production lost during processing. Loss percentages for composite crops are computed as a weighted average of the loss percentages of the aggregated simple commodities.

- **Data Sources** defines the derivation of the estimates. Several estimates may be included in the database for each location/commodity/season/year combination, i.e., estimates may be obtained from various sources at various dates. For example, the World Bank and the Ministry of Agriculture both may provide pre-harvest and post-harvest estimates.

Two time periods are used in AGMAN:

- **Harvest season** is required because individual commodities may be harvested more than once during a calendar year. Harvest seasons are user-defined, e.g., main season, early season, and late season.

- **Harvest year** is defined as the calendar year during which the harvest season occurred.

Location and commodity data are associated with the harvest season in which the commodity is harvested or estimated. AGMAN allows the user to select a single period of time or a series of time periods for analysis. A single analytical period could include a single harvest season and year, or all of the harvest seasons within a single year. For time series analysis, two

seasons/years may be specified for comparison purposes, or several seasons/years (not necessarily contiguous) may be specified against longer-term average summaries.

For each unique combination of location/commodity/season/year, AGMAN includes harvest estimates for production area (hectares) and gross production (metric tons). Net production is calculated by using the commodities loss percentage and gross production. Yield is calculated by dividing the net production by the production area. Each estimate record also contains the date and source.

3.2.3.1 Data Analysis/Products Generated

Four types of products may be generated for data analysis from the AGMAN database:

- **Production trend** displays production information for a set of years. Up to nine years of data may be included. The production information and the output products can be displayed as tables, or as pie, bar, line charts.

- **Production summary** displays statistical summaries of the production information provided by the production trend product. The summaries are generated for a set of years. Up to nine years of data may be included. The statistics generated are minimum, maximum, mean, standard deviation, and total. The summaries are generated separately for each type of production variable (gross production, production area, net production, and yield). The summaries are generated over all years for each combination of location and commodity selected. Production summary data can be displayed in tables, and maps (region and point).

- **Harvest profile** displays production information for selected locations and/or commodities. The production information includes gross production, production area, net production, and yield. Information can be displayed as tables, pie charts, or line charts.

- **Harvest comparison** is similar to the harvest profile product display except that it displays the location and commodity information for two different years and the difference between two values. Output products are tables, pie charts, or bar charts.

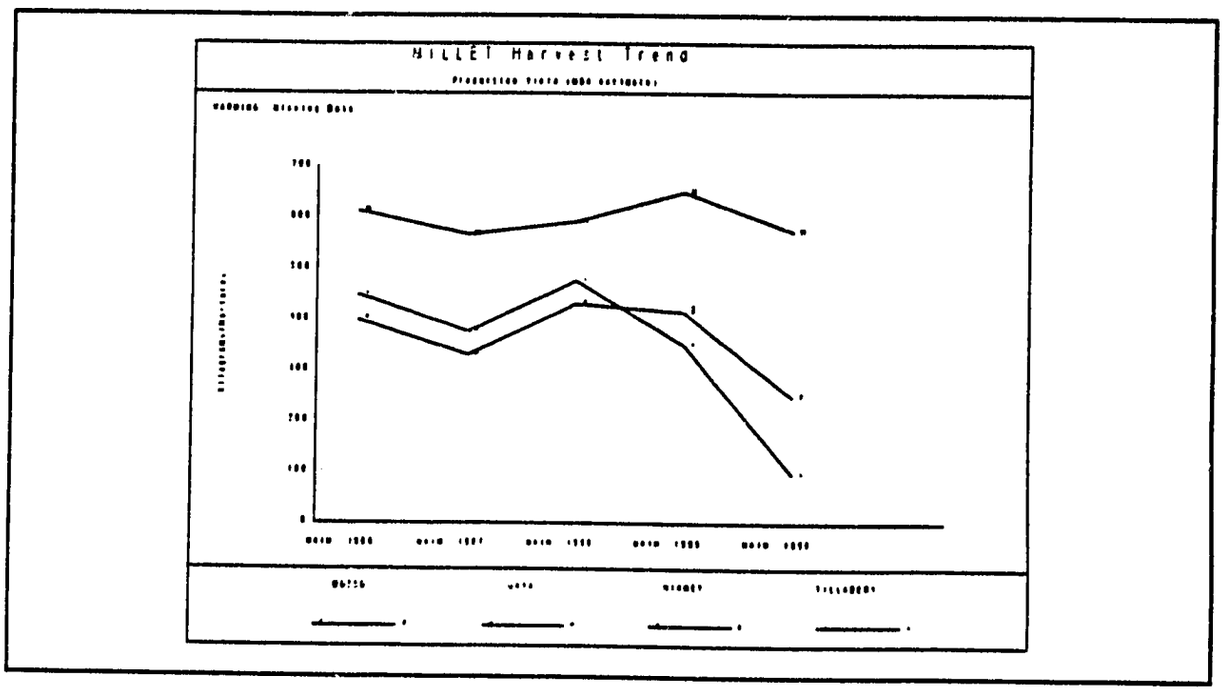
Sample AGMAN products are shown in Table 3.2 and Figure 3.2 below.

TABLE 3.2
SAMPLE OUTPUT FROM AGMAN

MILLET Harvest Trend
Production Yield (MOA estimate)

	MAIN1986	MAIN1987	MAIN1988	MAIN1989	MAIN1990	
DOSSO	399	330	430	415	248	kg/ha
GAYA	612	566	590	650	574	kg/ha
NIAMEY	M	M	M	421	M	kg/ha
TILLABERY	448	376	475	351	96	kg/ha

FIGURE 3.2
SAMPLE OUTPUT FROM AGMAN



3.2.4 Hardware and Software Requirements

AGMAN requires the following hardware and software resources to operate:

- 80286/386/486 processor with corresponding math coprocessor;
- VGA color graphics card and color monitor;
- high-density disk drive for installation, either 5.25 or 3.5;
- 640K of RAM expanded to 1 Megabyte (510K must be free to operate AGMAN);
- 5.9 megabytes of hard disk for the four subdirectories (2Mb reserved for data);
- DOS version 3.3 or higher.

Three high density diskettes are supplied for the installation of AGMAN.

3.3 REDATAM+

Unlike RAINMAN and AGMAN, REDATAM+ is not a FEWS-generated data manager. An acronym for **RE**trieval of **DATa** for small **A**reas by **M**icrocomputers ("PLUS" refers to the version of REDATAM used), REDATAM+ is an interactive, microcomputer-based system that provides access to geo-referenced, hierarchically arranged associations of very large data files, including the microdata of national censuses, aggregate statistics and large survey files. Although primarily intended for population data, REDATAM+ processes multi-disciplinary data for user-selected elements that may involve, for example, geographical areas or time periods. The data manager organizes and stores all data in these large files in such a way that any tabulations or other statistics can be produced readily by the user for the smallest hierarchical area defined in the data, such as a city block, or for any grouping of such hierarchical units.

REDATAM+ can store and efficiently work with complete census, or other similar data for small and medium sized countries, or regions and/or cities within a country. The software has been written with the capacity to manipulate basic data and generate statistics such as frequencies, cross tabulations and averages. It can also produce extracted files of selected records and variables for the areas of interest to permit further analysis by means of other statistical packages available for microcomputers such as SPSS-PC and SL-MICRO.

A decision to use REDATAM+ rather than to develop a FEWS-specific data manager for demographic data was made based on comparisons of cost and functionality. It was determined that REDATAM+ could serve most FEWS requirements, sparing the (considerable) expense of developing a FEWS-specific product. REDATAM+ can easily access data from a hierarchical database, define any geographical areas of interest, and rapidly produce tabulations for selected areas. The database manager has a GIS interface that allows for the export of REDATAM+ output to GIS packages for cartographic display and spatial analysis. In addition, REDATAM+ reduces the amount of disk space needed to store the database.

3.3.1 History of REDATAM+

Initiated by the Latin American Demographic Centre (CELADE), the REDATAM software had its origins in a needs assessment conducted in 1983, and began in response to specific problems encountered by countries in obtaining quantitative population data. During the early 1980s, many Latin American countries displayed a growing interest in the decentralization of planning to subnational units such as municipal and regional authorities.

Both national and local authorities require census and other population information for small areas, but integrated with related information from a variety of sources. One major need in this field was for rapidly available and low-cost population and housing information for small geographic areas. In addition, noting that the 1980 censuses were underutilized, CELADE (among others) was concerned that the upcoming 1990 censuses would bear a similar fate. Financed by the International Development Research Center (IDRC) of Canada, and support from the United Nations Population Fund (UNFPA), and the Canadian International Development Agency (CIDA), the REDATAM project was developed.

3.3.2 Relevance to FEWS Work

Demographic data are important to FEWS analysis in several ways. FEWS basic mandate is to identify specific populations at risk of food insecurity. This requires -- at a minimum -- a knowledge of estimated population numbers and their geographic distribution. Second, as FEWS methodology develops increasingly toward the use of household income as the key unit of analysis, a detailed knowledge of the demographic and socio-economic characteristics of specific populations becomes more crucial. REDATAM+ has the potential to organize the needed data in ways which will support increasingly sophisticated household-level analyses, drawing upon large census datasets as well as information from smaller-scale surveys.

3.3.3 Organization of Data[28]

REDATAM+ allows users to store any kind of information (not only demographic and not only geo-referenced), provided there are hierarchical relationships among the data.
Thus, data are arranged in a single geographical hierarchy, or branch. Each of the boxes shown is called an "entity". Each entity has one or more separate elements.

REDATAM+ has five major modules:

- **Configuration** is used for establishing the environmental parameters. It is also used to select the working language of the database;

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[28] REDATAM-Plus User's Manual. Latin American Demographic Centre (CELADE). December 1991.

- **Hierarchical Selection** is used to define the area for which statistics will be produced;

- **Processing** has many different facilities for data manipulation, record selection, the generation of statistics, and the printing of results. It also provides interfaces between REDATAM+ and other statistical packages;

- **Database Dictionary** contains the definition of all variables available in the REDATAM+ database; and

- **Database Administration** assists in the process of generating and loading new REDATAM+ databases. It also has other tools to check database consistency, database conversion, and creation of downloaded databases to be exported.

3.3.3.1 Data Analysis/Products Generated

Analyses on both quantitative criteria or geographical entities can be conducted. Cross-tabulations, averages, and frequencies can be done within REDATAM+; the output produced, in table form, is camera-ready. However, the results of the internal processes for geographic output must be exported to a GIS package, such as IDRISI, ARCINFO, or Atlas Graphics, for display.

3.3.4 Hardware and Software Requirements

Written in the C language, REDATAM+ operates on the IBM PC family of microcomputers, and IBM compatible machines. The system itself occupies approximately 5 MB of hard disk storage, and the demo database occupies about 1MB. Following are the minimum hardware and system software configuration required to install and run REDATAM+:

- 80286/386/486 processor with corresponding math coprocessor;
- a monochrome or color monitor;
- 640 KB of RAM Memory;
- 1 high density floppy disk drive;
- hard disk of 20 MB or more (depending on the size of the census data files to be loaded);
- a printer with a paper width of at least 80 characters; and
- DOS version 3.3 or higher.

Additional (optional) equipment may be needed if the user wants to interface the system with the GIS systems like ARC/INFO:

- a color monitor (EGA or VGA);
- a plotter; and
- a digitizer.

3.4 PRIX

PRIX is a market price management and analysis program developed by a FEWS field representative. The purpose of PRIX is to organize, manipulate, and store market price data and to use these data with Harvard Graphics to produce a predetermined selection of charts and graphics on the results of analysis. In addition, PRIX allows the user to output data to either dBase or ASCII files.

3.4.1 History of PRIX

In response to a felt need in the field, the FEWS FFR in Chad, in collaboration with the FEWS/W staff developed PRIX in 1991-92 to help in organizing market price data for that country. Other FFRs and FEWS/W personnel recognized it's value for the overall project. PRIX's author was requested to prepare the product for use in other countries and, eventually, for general distribution. PRIX has become a widely used data manager for market price data.

3.4.2 Relevance to FEWS Work

The behavior of market prices for key food items is an important ingredient in FEWS "convergence of evidence" approach. It allows FEWS analysts to see anomalies in prices which give an indication of food availability. In addition, PRIX allows FEWS to infer how prices might impact on food access. Comparisons of analytical products from PRIX with those from RAINMAN, AGMAN, REDATAM+, and from NDVI packages affords the FEWS analyst with a range of information from which inferences regarding food security in a particular location may be developed and tested.

3.4.3 Organization of Data

Data in PRIX are stored and accessed as dBase files. Pre-defined market, commodity, and time periods are resident in PRIX. However, the software allows the user to add to each of the files, as well as to define group markets and commodities. Price data is divided into monthly, weekly, or dekadal time periods. PRIX is comprised of eight different data files:

- **COMMODIT.DBF** contains all of the commodity codes and names (English, French, and abbreviations);
- **COMM_REF.DBF** contains all of the commodity codes and names (English, French, and abbreviations). This file differs from the above in that it stores the old commodity codes after new data are added (with different codes for the same commodity);

- **MARCHE.DBF** holds all of the market information related spatially (both administrative level and geo-referenced);

- **PRIX_MOI.DBF** contains the monthly price data as well as market and commodity codes;

- **PRIX_SEM.DBF** comprises the weekly price data as well as market and commodity codes;

- **PRIX_DEC.DBF** includes the dekadal price data as well as market and commodity codes;

- **PRIXCTRL.DBF** contains the parameters (e.g., country code, language of choice);

- **PRIXSKEL.DBF** allows the creation of the base file.

Data are best entered in PRIX, but can be entered in any format that can be read or imported into dBase, including LOTUS 123, dBase, and ASCII. However, the best alternative to using PRIX to enter data is to use dBase since this is the format that PRIX uses to store and access its data.

3.4.3.1 Data Analysis/Products Generated

Five types of analysis can be conducted using PRIX.

- **One or More Markets, One Product** is used in an early warning context to observe the historical and current behavior of prices for a single commodity in one or more markets to:

  - understand the price behavior of a specific commodity in a market(s) to identify, as early as possible, behaviors which have in the past resulted in food access problems for vulnerable socioeconomic groups;

  - capture any deviation or sudden departure of prices from a normal pattern that may signal either a change in the market availability and/or access of a particular commodity; and

  - identify the price behavior of a specific commodity over a given geographic area to observe if prices in different markets behave in similar ways.

  Data are generally displayed in a line graph.

- **One or More Products, One Market** is similar to the first in that it is another method for exploring some of the same issues: how have prices for a commodity in a particular market changed over time, and how does that assist to identify, as early as possible,

departures from normal price trends? The main difference of this analysis compared to the first is that the emphasis is on understanding the relationship of prices between commodities. Data are generally displayed in a line graph.

- **Terms of Trade Analysis of Two or More Products** is complementary to the two previous ones. The terms of trade analysis is a way of examining the relative purchasing power between socio-economic groups whose well-being depends on buying and/or selling a particular product(s). In an early warning context, this procedure is used to observe the historical and current relationship between two commodities within a given market to:

  - examine the historical relationship between the prices of two commodities in a given market to understand the pattern of changes in relative prices;

  - capture any deviation or sudden departure of prices from a normal pattern that may signal either a change in the relative purchasing power of different socioeconomic groups; and

  - capture any rapid price changes in the terms of trade between different socioeconomic groups to identify if a particular vulnerable group trading in their commodity is relative to the commodities traded by others.

Data are generally displayed by line graph, bar chart, or a combination of both.

- **Intra-year Analysis of a Time Range** is another method of looking at similar issues explored in the first two types of analysis. The difference is that this approach permits a closer examination of the pattern of prices of a particular commodity in a specific market by including different years on the same graph. This procedure is used to observe the historical and current behavior of prices for a single commodity in one market or market group for different years to:

  - understand historically the price behavior of a specific commodity in a market(s) to identify early behaviors which have in the past resulted in food access problems for vulnerable socioeconomic groups; and

  - capture any deviation or sudden departure of prices from a normal pattern that may signal a change in the market availability and/or access of a particular commodity.

Data are generally displayed by line graph.

- **Price Indices Based on a Reference Value** offers a method to compare prices in different markets that are of a different magnitude by standardizing them against a reference value. This procedure divides the price for each period by a user-defined reference value. This

procedure is used to observe the historical and current behavior of prices for a single commodity in one market or more markets against a reference value to:

- understand historically the behavior of prices for a specific commodity to observe deviations of prices from a known reference period; and

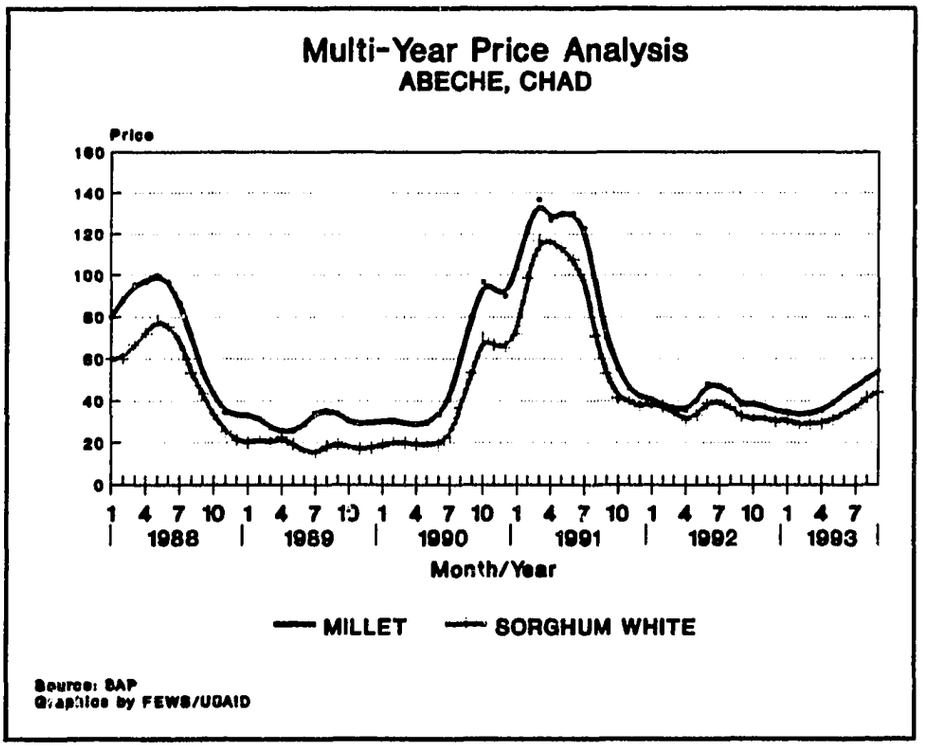
- conduct regional analysis (either within a country or across countries) to compare the deviation of prices.

Data are generally displayed by bar chart.

A sample analytical output from PRIX is shown in Figure 3.3 below.

FIGURE 3.3
SAMPLE OUTPUT FROM PRIX

One or More Products, One Market



3.4.4 Hardware and Software Requirements

PRIX is a front-end menu system that allows the user to select options and have built-in batch files perform various manipulations of data files, including file updates, variable modification or creation, and specific analytical operations. PRIX uses Harvard Graphics to display output. The minimum hardware and software needed to run PRIX are listed below:

- 80286/386/486 processor with corresponding math coprocessor;
- an IBM or IBM-compatible computer;
- at least 512 K memory;
- a monochrome or color monitor;
- Harvard Graphics (version 2.3);
- a graphics adapter (if using and EGA card, at least 256K must be available);
- approximately 6.5 megabytes of hard disk space (space is required by a combination of PRIX, Harvard Graphics, and data);
- to produce charts, a printer, plotter, or other output device.
- DOS version 3.3 or higher;

3.5 ASSOCIATED PRODUCTION TOOLS

Since it's inception in 1985, FEWS has used the latest microcomputer-based technology for analysis and for presentation purposes. During the decade following the introduction of the PC, there was unprecedented growth in software written specifically for this environment. In a fundamental way, this software differed from earlier generations of software written for mainframes and minicomputers (and workstations): PC software was developed to take advantage of the personal interaction between the *user* (not the professional computer programmer or operator) and the PC. This required a whole new way of thinking about how human beings interact with and use computers. The new perspective spawned the development of *generic* software: first word processing (*Wordstar, Word Perfect*) and databases (*Condor, Knowledgeman, dBase II*), then spreadsheets (*Visicalc, SuperCalc, Multiplan, Lotus*). *Generic software* was also developed for data communications purposes (*XModem, ProComm*), for graphics (*Harvard Graphics*, and graphing routines written into most spreadsheets), for mapping (*Atlas Graphics*), for statistics (*SPSS-micro, SAS-PC, StatGraphics*), and for other purposes. What in 1994 seems commonplace, i.e., the abundant availability of powerful, *generic*, off-the-shelf software which can be purchased at the corner computer store or software vendor, is in fact a revolutionary development which has occurred during the past decade...during the same period FEWS was developing and refining its analytical and presentation capabilities.

FEWS is a beneficiary of this revolution. In its effort to keep up with the latest technology, the FEWS project experimented with a variety of software packages to facilitate its work, adopting those which had promise and discarding those which added little to existing capabilities. In

1994, FEWS continues to look for better production tools to enhance its output, taking advantage of the enormous, market-driven software development engine which is totally without precedent.

3.5.1 Operating Systems

FEWS remains, for the most part, a DOS-based operation, although Microsoft Windows applications are increasingly being infused. Like many computer-literate users, the greater efficiency of DOS-based software -- which, for the most part, does not suffer from the overhead required to create the Graphical User Interfaces (GUI) which many (especially new) PC users find attractive -- has proven to be durable within FEWS. However, some powerful graphics-based routines are available only in Windows software (e.g., desktop-publishing, and object linking and embedding (OLE)); these will inevitably result in FEWS moving increasingly toward a GUI-based environment.

3.5.2 Word Processing

At present, *WordPerfect* is the standard word processing package, and has been almost from the project's inception. As *WordPerfect* releases new versions of the software, FEWS upgrades. Currently, the two latest versions of the *WordPerfect* software -- 5.1 and 6.0a -- are being employed by the FEWS/W staff and the FFRs.

3.5.3 Spreadsheets

Spreadsheets are created primarily in *Lotus*, however, some FFRs in the field and FEWS/W use *Quattro Pro* and/or *Excel*. The two software packages interface easily. Graphs, charts and tables are produced in either *Lotus, Excel, Quattro Pro, Harvard Graphics,* or *StatGraphics*, depending upon what is desired and the database from which the output is being generated.

3.5.4 Relational Database Managers

As mentioned above, dBase is utilized as the basic structure for FEWS data management and analysis. RAINMAN, PRIX, and AGMAN data are stored in dBase. This software was chosen for its flexible format, i.e., information can be directly exported to AGIS and other GIS software for map production, and into various graphics packages such as Harvard Graphics, Lotus, etc. Not only is dBase used for data analysis, the FEWS project also maintains their mailing lists, and project inventory in dBase.

3.5.5 Desktop Publishing

While FEWS computer operations remain primarily DOS-based, certain parts of the report production process have been moved to a Windows environment. The trimestral reports, scripted in *WordPerfect*, are imported into *Pagemaker*, a desktop publishing software package, where they are cleaned and made camera-ready. The files are then transferred electronically to the printer. The production of the FEWS Bulletins, likewise, is facilitated by *Pagemaker* and *Adobe Illustrator*. Some FEWS/W staff and FFRs work in a Windows environment producing spreadsheets in *Excel*, and for file and disk management. In addition, FEWS/W recently acquired a Window-based copy of *AGIS*. However, most FFRs and FEWS/W continue to operate in a DOS environment.

3.5.6 Graphics and Mapping

Graphs are produced in several ways: (1) directly from the Data Managers such as *RAINMAN*, *PRIX*, and *AGMAN*; (2) indirectly from the Data Managers (*RAINMAN, AGMAN*); (3) from spreadsheets (*Lotus, Quattro Pro, Excel*) or spreadsheets and databases imported into a graphics package (*Harvard Graphics*); and (4) directly or indirectly from other FEWS packages such as *IDA*. A contouring package, *Surfer*, is used to graphically represent datasets (from spreadsheets or databases), depicting numeric values as visual contours.

3.5.7 Utilities

FEWS uses a number of software utilities for file maintenance and backup, file transfer, file error correction, graphics file conversion, etc. Most frequently used among these are: Norton Commander, and Norton Utilities.

Pizzazz is a "screen grabber" utility which allows the user to obtain hard copy from IDA. (IDA does not have a built-in capacity to produce imagery output.) *Pizzazz* permits the user to capture what is on screen and manipulate the quality, i.e., change the colors, eliminate what is not wanted, etc., and print out the final product. This software also allows files to be exported into a variety of packages.

3.5.8 HyperText

HyperText is a multilayered text program that allows a user to skim through text, in this case ***FEWS NEWS***, and move to different levels of detail by clicking (mouse) on highlighted words. FEWS uses the DOS version of *HyperText*. It can be used on any platform -- 286, 386, or 486 -- with any graphics card.

SECTION 4.0 COMMUNICATION TOOLS

FEWS can be thought of as a distributed information system, with component parts located in 10 African countries and several U.S. locations (including the FEWS/Washington, D.C. headquarters, Tulane University in New Orleans, LA, the EROS Data Center in Sioux Falls, SD, NASA at the Goddard Space Flight Center in Greenbelt, MD, etc.). In addition, there are a number of organizations with which FEWS regularly interacts, including the United Nations Food and Agriculture Organization (FAO) and the World Food Program (WFP) in Rome, Italy; UN field offices in Africa, the Agrhymet organization in Niamey, Niger; the University of Reading in England; and numerous nongovernmental organizations (NGOs). FEWS is a data intensive activity: data are the lifeblood of the project. There is a commensurate need to be able to move data quickly and efficiently from place to place on a regular basis, as well as to communicate messages, instructions, budgets, plans, vouchers, documents of all sorts, and all the other technical, management and administrative information which is attendant to the project.

In early years, FEWS communication took place in traditional ways: official A.I.D. cables, telex, fax, telephone, and fast courier services (FEDEX and DHL). In the past two years, the project has begun using new electronic communications tools, including a dedicated dial-up E-mail network (*FEWSNET*), the *Internet*, and local area networks (LAN) in the U.S. Of these, *FEWSNET* is the most heavily used. Most of this Section is therefore devoted to this network. The other two modes of communication are described briefly below.

4.1 *FEWSNET*

Since 1992, the Famine Early Warning System (FEWS) project has operated its own data communications network known as ***FEWSNET***, linking the FEWS offices in 10 African countries[29] with the FEWS headquarters located in Rosslyn, VA. In a very short time ***FEWSNET*** has become the key communications tool used by the FEWS project to carry messages and files between field offices and those in the U.S., thus reducing dependency on courier services (e.g., FEDEX, DHL), telex, cables, and voice (telephone) channels.

FEWSNET takes advantage of the latest technologies appropriate for sending messages and files at high speeds over regular dial-up telephone lines. The system is basically a store-and-forward one (analogous to dropping a letter in the mailbox and letting the post office worry about

[29] As of June 1994, Mauritania, Niger, Burkina Faso, Mali, Chad, Ethiopia, Kenya, Malawi, Zambia, and Zimbabwe were included in the net. While ***FEWSNET*** is operated as a "closed net" (i.e., a net operated primarily for the benefit of a select group to achieve a specific purpose), it has the capacity to connect with most other popular datanets (such as Internet) and, in fact, does so reguiarly.

delivering it to the intended addressee), and it has the potential to save a great deal of time and expense in shuttling messages, data and image files, and other machine-readable files back and forth at amazingly high speed[30] over regular phone lines. This technology is complex and is evolving rapidly. However, FEWS has chosen to focus on two central uses: (1) to send and receive messages; and (2) to send and receive files. This chapter will examine the technology in some detail, but will focus on present and potential utilization of electronic data communications technologies to better serve FEWS operational requirements.

4.1.1 The Technology

Sending data rapidly over regular dial-up telephone lines ***without the sender's or receiver's direct involvement during transmissions*** requires: (1) a computer (in this case, a personal computer (PC) running the DOS operating system or having a "DOS window", e.g., under Microsoft Windows or IBM OS/2); (2) appropriate software consisting of a **message editor/reader** and a **mailer**; (3) a high-speed modem; and (4) direct access to a telephone line into which the modem can be physically connected. Given these four requirements, individuals with only minimal training -- one day or less -- can communicate regularly with one another over any desired distance, including worldwide links. In practice, a **fifth requirement** is essential if a network operation such as ***FEWSNET*** is to be implemented: at least one of the stations on the net, or a third-party vendor, must serve as a bossnode or hub.

4.1.1.1 E-Mail Software and Computer Requirements

FEWSNET is built upon a highly-capable class of FTSC-compatible[31] software running under MS-DOS. FTSC is the communications protocol upon which FIDONET is based. This is the largest privately-operated network, with over 25,000 nodes and more than a million users worldwide. At present, the most advanced software packages which are FTSC-compatible only run under DOS. ***FrontDoor*** and its spinoff cousin ***InterMail*** are nearly identical, powerful mailer packages. Both are used by ***FEWSNET***, and are run on a variety of laptop and desktop computers.

Computer requirements for these packages are minimal: i286, 386, or 486-based microprocessor, MS-DOS 2.2 or higher, 512k RAM, a hard disk (preferred), and a serial communications port,

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[30] Current technology permits data to flow at up to about 57,000 bits per second, or about 5,500 characters (the equivalent of about 1,140 words per second). In practice, speeds are somewhat slower due to a variety of reasons, averaging about 400-500 words per second for an average Word Perfect file. A new class of high-speed modems known as V.FC or V-Fast became available in mid-1994. Over relatively good dialup lines, these modems can exceed former speed limits by two to three times.

[31] FTSC-compatible means software compatible with FIDONET protocols as developed by Tom Jennings; a number of shareware and commercial packages have this capability, and will run on many types of computers. The FTSC protocol is very robust and ubiquitous.

preferably with a high-speed serial chip (16550-type UART). The software itself takes up approximately one megabyte of hard disk space, while companion ***nodelists*** and other files may occupy up to three additional megabytes. At this writing, several separate efforts are underway to write new, compact, simplified, and user-friendly FTSC-compatible mailers suitable for use as **points**[32] on a network.

An uninterruptable power supply (UPS) is essential to ensure continuous performance during periods of electricity outage, and to protect the computer and associated equipment from dangerous powerline transients. A capacity of 300 watts is the minimum requirement; greater capacity is better since it supports the ability to run additional equipment (e.g., a printer) and provides longer service during power outages. These units cost anywhere from $200 to $1000 at discount stores in the U.S.

4.1.1.2 Modem and Telephone Line Requirements

An internal or external high-speed modem having either v32 or v32bis speed potential (9600 or 14,400 bps respectively) and v42bis compression and error correction is highly desirable, although other modems may be used. A v32bis/v42bis modem is just about state-of-the-art as of early 1994. However, other higher speed modems and protocols having modem speeds of 28,800 bps are becoming available as of June 1994. The speeds referred to are those used by the modems to communicate with one another (known as DTE speeds). Note that they are NOT the same as DCE speeds, i.e., those used to communicate between the computer and the modem. Modern modems use built-in compression techniques which can increase effective throughput of data up to four times the modem (DTE) speed, i.e., a 9600 bps modem can, optimally, actually move data at a speed up to 38,400 bps. The actual throughput of data depends upon the size and type of file being sent, telephone line conditions, and other factors. In practice, an uncompressed file (such as a Word Perfect document) can be throughput at just over half the theoretical maximum speed, or about 22,600 bps in the case of a 9600 bps (v32/v42bis) modem. Bitmapped image files often can be transferred at even higher rates, sometimes approaching the theoretical maximum.

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[32] The FIDONET addressing system has four levels: region, zone, net, and point. All FIDONET (and ***FEWSNET***) addresses conform to a specified architecture, e.g., 1:109/349.173 in which the "1:" refers to the first region (North America), the "109" to an East Coast Net, the "349" to a particular bossnode, and the ".173" to a specific user (the author). Using this addressing system, a message or file can be sent from anywhere in the world and will reach the intended individual, or point. The main difference between a point and a node or bossnode in the FIDONET system is that a point station normally does not relay traffic for other stations, but rather carries out most traffic directly with its bossnode. It CAN, however, send mail directly to any other hub, node, or point if desired.

The FEWS project has experimented with several types of modems to determine which ones are most effective over the sometimes very poor phone lines between the U.S. and Africa. There is no clear winner, and the matter is considerably complicated by some or all of the following factors:

- a wide variety of computer equipment being used with different configurations;
- a variety of modems, some of which are configured differently to attempt to optimize local operating conditions;
- different line conditions each time a call is placed[33]; different routing; different combination of land lines, microwave, and satellite links during each overseas call; and
- a variety of configurations as a result of trying to adjust to local operating conditions.

A simplified schema of dialup telephone lines between the U.S. and Africa is shown in Figure 4.1. Ideally, the telephone line should be direct (i.e., not through a switchboard), a 1040 line (relatively clean for data transmission) and be dedicated 100% of the time to the data application. These last two points are not absolutely essential, since any direct line will work reasonably well, though perhaps with reduced throughput. It is possible to use the same line for voice and data communications either by manual or automatic switching between the two functions. Automatic switching devices are available for $75 to $135 which allow a single phone line to serve voice, data, and fax functions. In practice, however, these have often proved more troublesome than useful, particularly in the field where telephone ringing protocols and parameters differ from country to country. In the U.S., many local telephone companies offer "distinctive ring" service (where one line is used for two telephone numbers, each with its own distinctive ringing pattern). ***InterMail*** software works well with distinctive ring lines. A recent modification to the ***InterMail*** software, made at FEWS' request, supports calls through a switchboard or, in the case of travellers, a hotel operator.

4.1.1.3 Bossnodes and Hubs: An Electronic Postal Service

The bossnode or hub performs exactly the same function as the postal service: it accepts the messages or files sent and ensures that they are properly routed and delivered to the desired recipient(s). It also delivers messages or files -- those which others have deposited to a bossnode

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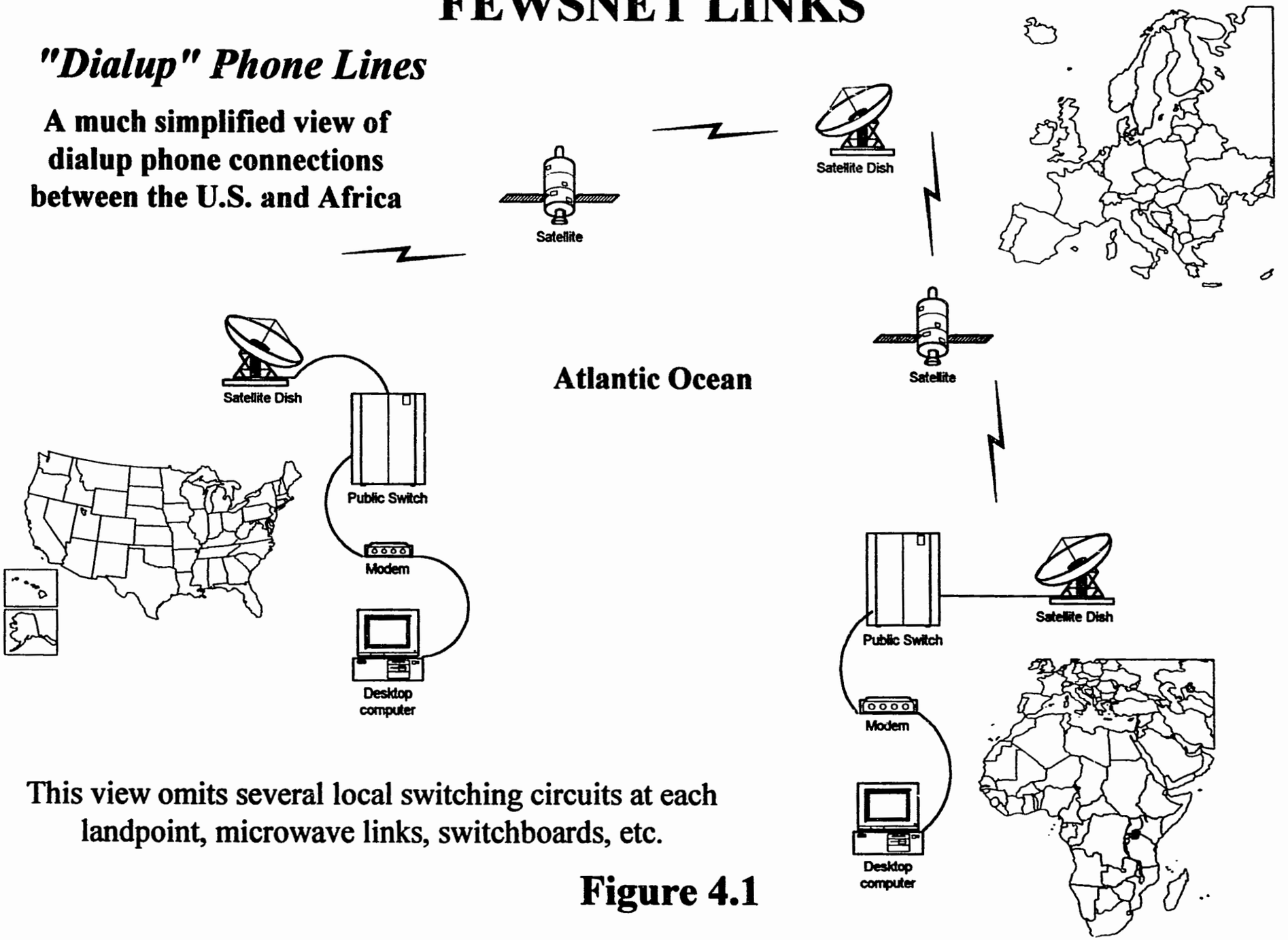
[33] When a call is placed from Washington to Niamey, for example, it may be routed through a variety of systems. First, routing is through the local telephone company's land lines and switching center to the long distance carrier. From there, routing may be done by a combination of landlines, microwave, and satellite links to the country of destination, sometimes passing through switching equipment in third countries. Once in Niger, the call is then switched through local landlines to the phone being called. Each step of the way presents a very real potential for signal degradation to take place. See Figure 4.1.

FEWSNET LINKS

"Dialup" Phone Lines

A much simplified view of dialup phone connections between the U.S. and Africa



This view omits several local switching circuits at each landpoint, microwave links, switchboards, etc.

Figure 4.1

or hub. These processes of accepting files, routing and forwarding them appropriately, and delivering them to the destination computer are performed automatically, without operator intervention. They are carried out at high speed, but not in real time. In other words, there is a delay between the time a message or file is deposited to the bossnode and the time the bossnode actually delivers it directly to the recipient computer or to another bossnode enroute to the intended computer. The delay is dependent on a variety of factors but is minimal (a few seconds or minutes) in the case of stations which are always on line (dedicated stations) or can be several hours or even days in the case of computers which are put on line periodically to send and receive mail. The delays can be greatly affected by the quality of phone lines, particularly those to developing countries such as are used routinely by ***FEWSNET***.

There are several companies now offering bossnode-type services. For a fee, a message or file can be posted with them and they will ensure its delivery to any designated computer. Some now have worldwide service. The drawback to these systems is that they can be expensive if the volume of data is large -- as in the case of FEWS -- and they are by definition "insecure" systems; that is, data are handled by a third party over which there is no effective control[34]. Still, for many applications these services are attractive alternatives to operating an in-house system. FEWS has chosen to operate its own bossnode or hub (located in Arlington, VA) for reliability and cost reasons.

Within each of the five main factors discussed above (i.e., hardware, software, modem, telephone line, and bossnode or hub), a large number of variations is possible; acting in tandem as they do, the combinations and permutations become very large in number, making testing and diagnosis difficult. That very good, unattended data transfer capacity can be established **despite** these factors is a tribute to the extraordinary technology now widely available and currently employed by ***FEWSNET***, as well as the skill of those who install and operate the network.

4.1.1.4 Cost

Hardware and software costs to set up an electronic data communication system such as that described above are modest. A complete PC computer system appropriate to the task can be purchased new for $1,000 to $1,500. A suitable modem costs between $300 and $1000 (retail price). Software costs run approximately $200 for each installation. Added to these costs, however, are the following: training; setup; telephone charges; service & maintenance; and, in the case of high-traffic nets, full- or part-time operator costs for the bossnode or hub. ***FEWSNET*** telephone charges are the most costly factor since virtually all traffic flow is between the U.S. and Africa. To minimize these costs, a star configuration has been chosen for the net, i.e., all stations in Africa are set up as points operating off a hub (bossnode) located in Rosslyn,

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[34] **Data security**, however, can be maintained when using such services through message and file encryption before transmission and after reception. Several software programs are available which can be used in conjunction with E-mail.

VA. Further, almost all calls are placed to the points from the U.S. This scheme takes advantage of **price** (it's much cheaper to call Africa from the U.S. than the reverse) and **quality/reliability** (there is a better chance of connecting from the U.S. to a point in Africa than from a point in Africa to the U.S. or even to another point in Africa). In practice, however, costs are sometimes considerably higher than they could or should be due to glitches which occur over poor phone links, especially in unattended operation[35]. As FEWS gains experience with these situations it will be possible to further reduce operating costs of the system.

4.1.1.5 Further Reading

Persons desiring further information on the technologies employed in ***FEWSNET*** may wish to consult the following sources:

InterMail and ***Front Door*** User Manuals.
Dvorak's Guide to PC Telecommunications, Osborne McGraw-Hill, 1992.
The Whole Internet, Ed Krol, Sebastopol, CA: O'Reilly & Associates, Inc., May 1993.
Introduction to PC Communications, Bob Becker, Carmel, IN: QUE, 1992.
Using Computer Bulletin Boards, John V. Hedtke, Portland: MIS Press, 1990.

4.1.2 *FEWSNET* Structure and Operation

4.1.2.1 The *FEWSNET* Architecture

FEWSNET was conceived in early 1992 as an effort to link FEWS Field Representatives (FFRs) in six countries in subSaharan Africa with the FEWS headquarters office located in Rosslyn, VA. The purpose was to provide a two-way data communication services on a 24-hour basis. As FEWS FFRs were placed in four additional countries in east and southern Africa in late 1992-early 1993, they were also included. A part-time system operator (sysop) was employed for about one year in FEWS headquarters to operate and improve the net. In late 1993, a full-time sysop was recruited to manage ***FEWSNET*** and the LAN located in FEWS headquarters.

4.1.2.2 LAN Operation

FEWSNET is accessible to each of the 13 workstations on the LAN at the FEWS headquarters office. The seven persons listed at node 1:109/173 (see Annex 1) -- as well as others as appropriate -- are able to send and receive messages and files directly from their desks. This

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[35] For example, the bossnode computer may call a point station in Africa repeatedly when the station answers but fails to connect properly, incurring a new telephone charge for each attempted connect. Or the two modems may fall back to a slower speed due to extremely poor line conditions, greatly increasing the time required to send a very large file.

facility, available since the spring of 1993, greatly facilitates access to the net by headquarters staff.

Links to the larger FIDONET, Internet, CompuServe, and other on-line services are implemented within ***FEWSNET*** as well, providing access to literally millions of computer users and databases worldwide. It is also possible to carry out E-mail messaging with the extensive A.I.D. LAN located in the Washington area.

4.1.2.3 Logging Achievements to Date

The E-mail software used in ***FEWSNET*** automatically records each transaction. Several types of logs are kept of each individual message or file sent from or to the ***FEWSNET*** hub. These logs permit the systems operator (sysop) to track actual activity on the net, and provide detailed information useful for traffic analysis and for technical and managerial oversight (e.g., pinpointing troublesome points, assessing performance/throughput, estimating costs, etc.). Currently, two telephone lines are employed at the hub (with two modems) to accommodate the broad range of modems in use and line conditions. Thus, two sets of logs are kept, one for each line.

FEWSNET is in daily use and handles a high volume of traffic, including messages and long data files. Table 4.1 is a sample summary report for one of the telephone lines during the month of July 1993. A total of 13.6mb of messages and files were sent FROM the hub on that one telephone line during that month, while approximately 11.4mb of messages and files were received. Messages are generally short and are often compressed into packets before sending, greatly reducing the number of bytes sent/received and recorded.

While ***FEWSNET*** has been in operation for only little more than one year, it has become an important tool for communicating a wide range of information between the field and the headquarters office, and between other locations. It may be instructive to take a closer look at WHAT is being communicated. Data required for such an analysis are contained in the network logs; a portion of one is illustrated in Table 4.1.

TABLE 4.1

IMLFA V1.0

Report Period: Thu 01 Jul 93 thru Sun 01 Aug 93

Net/Node Number	Total Files Sent	Total Files Rcvd	Total Bytes Outbound	Total Bytes Inbound	Connect Time
11:202/101	0	18	0	132594	00:03:08
1:109/10	0	7	0	12467	00:00:41
1:109/100	30	120	45852	1001557	00:30:33
1:109/136	2	1	661	168508	00:02:53
1:109/151	12	3	27004	4735	00:01:16
1:109/173.21	39	4	549374	3659	00:30:24
1:109/173.22	2	2	17279	20159	00:01:21
1:109/173.23	37	10	250906	20779	00:44:49
1:109/173.24	1	1	4092	7418	00:00:47
*1:109/173.25	27	14	305458	66618	00:26:13
1:109/173.29	19	18	1147450	741427	00:33:59
1:109/173.30	14	8	86024	64853	00:08:11
1:109/173.34	2	0	5394	0	00:00:30
1:109/173.38	13	11	109353	225114	00:57:57
*1:109/173.41	46	40	279852	3407111	04:32:46
1:109/173.42	17	12	706260	12067	00:54:18
1:109/173.46	2	1	3779	2753	00:00:53
1:109/176	1	4	411	1097	00:00:31
1:109/183	12	18	906686	143237	00:18:48
1:109/183.202	4	0	506005	0	00:03:09
*1:109/190	55	24	2758856	298538	00:33:43
1:109/190.1	3	0	52410	0	00:00:53
1:109/229	8	12	791	823294	00:13:52
1:109/349	46	57	179467	2003439	00:40:09
1:109/349.2	0	1	0	336	00:00:06
1:109/401	1	0	719	0	00:00:21
1:109/416	0	2	0	2094	00:00:26
1:109/70	0	16	0	32109	00:02:49
1:109/70.984	2	6	11785	13872	00:01:06
1:249/114	3	5	1343	234261	00:05:32
1:288/8	55	20	4485715	1358998	01:45:01
1:352/111	2	7	259	603490	00:07:29
1:369/102	0	1	0	4572	00:00:08
1:369/35	0	1	0	560	00:00:06
2:254/70	2	0	141671	0	00:01:37
5:761/1.94	6	0	1012962	0	00:01:20
85:880/311	0	3	0	7066	00:00:55
TOTALS	463	447	13597818	11418782	13:28:40

* A transfer failed with this node. Check detail reports.
This copy of IMLFA Registered to: Mark Prado @ Internet Gateway

As shown in Table 4.2, a total of 1+mb of messages were sent from the hub and approximately 600kb of messages were received on just one of the two telephone lines. Since message transfers are generally quite short, often only 200-300 bytes, the total of 1.7mb implies many hundreds of messages being sent/received on this one line during the month of July.

TABLE 4.2

MESSAGE TRANSFERS

Zone:Net/Node Number	— Msg Transfers — Sent	Rcvd	Total	—— Message Bytes —— Sent	Rcvd	Total
1:109/349	43	14	57	177,652	99,540	277,192
1:109/173.21	22	4	26	157,511	3,659	161,170
1:109/100	24	15	39	36,861	12,924	49,785
1:109/183	10	14	24	41,182	51,745	92,927
1:288/8	22	15	37	48,814	18,464	67,278
1:109/173.34	2	0	2	5,394	0	5,394
1:109/173.23	17	9	26	101,668	14,906	116,574
1:109/190	21	12	33	45,820	33,862	79,682
1:109/229	4	4	8	689	2,786	3,475
1:109/173.38	11	8	19	13,823	80,024	93,847
1:109/173.41	33	16	49	127,047	63,101	190,148
1:109/173.24	1	1	2	4,092	7,418	11,510
11:202/101	0	15	15	0	48,273	48,273
1:109/173.42	8	0	8	52,545	0	52,545
1:109/70.984	1	6	7	4,772	13,872	18,644
1:109/173.25	14	11	25	145,009	27,513	172,522
1:369/102	0	1	1	0	4,572	4,572
1:109/10	0	1	1	0	4,485	4,485
1:109/151	6	0	6	11,346	0	11,346
1:109/173.22	1	1	2	15,576	13,669	29,245
1:109/176	1	3	4	411	1,090	1,501
1:109/173.29	13	13	26	88,367	63,904	152,271
1:109/173.30	7	6	13	55,040	21,929	76,969
1:109/190.1	2	0	2	448	0	448
1:109/173.46	2	1	3	3,779	2,753	6,532
1:109/183.202	3	0	3	3,597	0	3,597
5:761/1.94	4	0	4	4,212	0	4,212
2:254/70	1	0	1	1,051	0	1,051
85:880/311	0	2	2	0	3,437	3,437
1:109/349.2	0	1	1	0	336	336
1:369/35	0	1	1	0	560	560
1:352/111	1	1	2	200	1,294	1,494
1:249/114	2	0	2	1,308	0	1,308
1:109/136	1	0	1	647	0	647
1:109/401	1	0	1	719	0	719
TOTALS	278	175	453	1,149,580	596,116	1,745,696

(This log shows MESSAGE TRANSFERS ONLY during the month of July 1993).

File transfers make up the bulk of traffic handled on the net, representing 22mb of data sent and received on just one of the two lines during the month of July 1993 (a total of 34mb was handled on both lines during this period). An analysis of the types of files sent is revealing. The list includes:

. satellite imagery files
. boundary files for GIS
. document files
. program files (including several types)
. data files (agricultural, census, rainfall, crop, nodelist, etc.)
. spreadsheet files
. graphics files
. message files (sent as word processing files).

In short, file transfers represent the range of information FEWS normally handles. In the absence of ***FEWSNET*** these transfers likely would be made by using services such as DHL, or overseas travelers.

4.1.2.4 *FEWSNET* Traffic Analysis

Figures 4.2 and 4.3 on the next page are illustrative of the types and relative quantities of messages and files transmitted over FEWSNET. These reflect traffic during the month of July 1993 to and from the FEWS headquarters office in Washington ***over just one of the two lines.***

As can be seen, the overwhelming volume of traffic handled is "other files". These consist of program, boundary, database, document, graphics, and other types of digital files. The category "imagery" reflects those *processed imagery files* prepared by FEWS Washington staff from imagery files received from NASA (NDVI) and from the University of Reading (CCD).

While detailed analyses have not been done over a sustained period (although the data exist for such analyses if it were desired to perform them), the strong impression of FEWS staff is that the use of FEWSNET is increasing substantially.

It can be anticipated that further increases will occur, particularly in the use of echomail, over the next year.

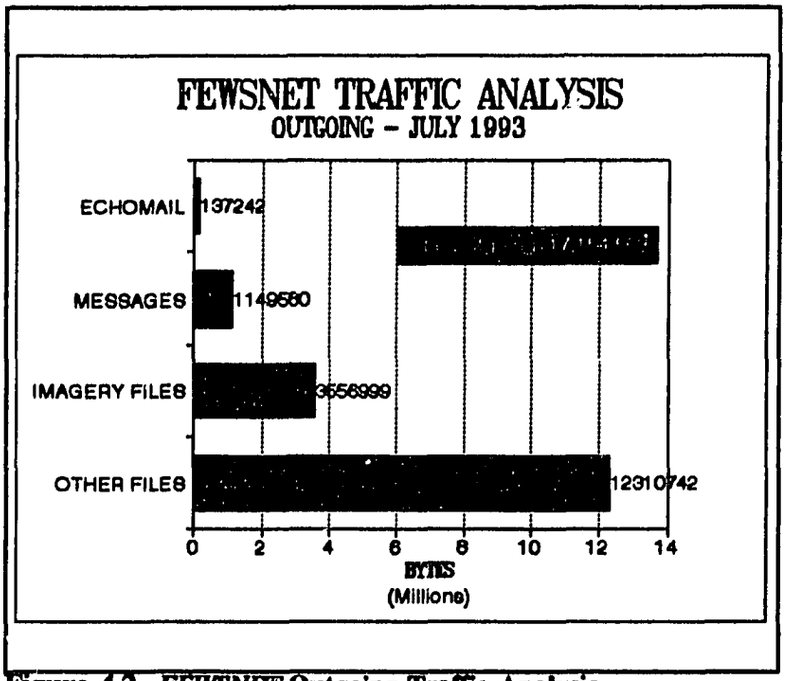

Figure 4.2 ***FEWSNET*** **Outgoing Traffic Analysis**

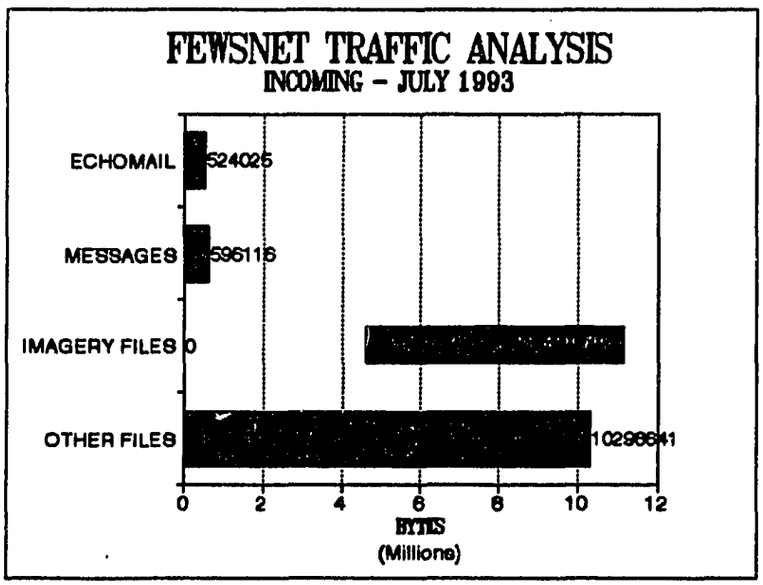

Figure 4.3 ***FEWSNET*** **Incoming Traffic Analysis**

4.1.2.5 Training, Operations, and System Maintenance

Training of persons on the FEWS network was limited in many cases due to an abbreviated training period for Southern Africa staff, and implementation of FEWSNET while Sahel staff were at field sites. Many sites came on-line at different times. However, given the above constraints, the FFR's, hub manager, and technical consultants have managed to make the system work. In some cases it was baptism by fire -- the wide diversity of equipment and location-specific factors posed some communication problems. An outside consultant was hired to work out these snags, which largely has been done. As of this writing, all overseas points are up and running.

Maintenance and upgrading of the ***FEWSNET*** hub in Arlington, VA has been done through a combination of on-site work (by sysops and consultants) and remote monitoring and maintenance. The system is configured to allow a telecommunications consultant to remotely access the files associated with ***FEWSNET*** to monitor performance and, as required, to remotely "tweak" the system for better efficiency or reliability.

While **system performance** is now pretty good, hindsight suggests that a more standardized approach to configuration and set-up likely would have helped to avoid hardware, software, and operator-induced problems. If budget had allowed, the ideal would have been to procure laptop computers with modems and software already installed and configured for use as dedicated points on the ***FEWSNET*** system and to carry out hands-on training of each FFR and other principal user[36].

4.1.2.6 Future Improvements to System Reliability

Dial-up Links. Advancements in international dial-up telephone systems (fiber optic cables), modem capabilities and performance, and serial (UART) chip upgrades have the potential for improving future system performance. Additional training of operators could also minimize sporadic downtime. This is particularly important for the FFRs. As budget permits, a greater degree of standardization of computers, modems, and software (including their configuration), and the use of dedicated phone lines and computers as well as improved calling/routing procedures will help reduce communication obstacles between the field and AID/W and between field offices, and ensure that those obstacles can be overcome.

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[36] This approach was taken by the ***SAFIRE*** network (which also operates in multiple southern African countries) and which has had high reliability, albeit in sending much smaller files and at slower speeds than ***FEWSNET***. ***SAFIRE*** has also benefitted from having a full-time system operator (sysop) since inception. Several other such networks based on Fido technology have been established and successfully operated recently, drawing upon the growing body of experience with international E-mail applications based on dial-up telephone circuits.

Satellite-based links. The potential use of satellite-based links bears special mention, since these have by far the greatest potential for achieving greater reliability and overall system efficiency in the future. Heretofore, this technology has been prohibitively expensive. An Inmarsat portable terminal, for example, costs about $25-$35,000 plus $8 to $10 per minute of use. However, there are several new classes of equipment and service which offer tremendous capacity and reliability for data-intensive operations such as FEWS, provided that there are a sufficient number of users to defray the initial equipment costs and the monthly operating costs. Among these new services, COMSAT's V-Sat system seems most promising. Ground terminals for V-Sat operation cost about $12,000. There is a monthly charge for rental of a satellite channel, but **no charge for the volume of data carried by the channel.** The rental charges are complex, depending upon bandwidth and power needed. Rental charges also are divided into up-link and down-link costs, and divided between the host country and the hub (U.S.). There is also a rental charge for the mother station (hub). At present, these charges still make V-Sat prohibitively expensive for FEWS. However, if an organization such as A.I.D. or the U.N. should decide to establish a V-Sat network in Africa[37], the incremental costs of adding additional ground stations could well drop to the point where FEWS could make use of direct satellite links both for voice and data operations.

Another new technology which might be useful for messaging and other less data-intensive functions of FEWS is based on Inmarsat-C. Equipment costs are now down to approximately $5,000, including a transceiver, software and antenna, though present usage rates are high -- $1.00 per 100 characters. Given the cost history of this technology, it is likely that both hardware and usage costs will decline significantly in the next 12-18 months. Installation and operation of this equipment is very straightforward.

Within a few years, satellite-based cellular technology such as Motorola's planned Iridium system may offer more reliable and more cost-effective links for some types of FEWS messaging and file transfer, particularly if the expected high volume of demand worldwide can bring costs down. The ability to access these communications channels from virtually any point on earth using small, highly portable cellular telephones will likely be useful to FEWS in that messaging, voice, and file transfer will be (technically) possible anytime, anywhere.

4.1.3 *FEWSNET* Set-Up and Network Operations - Lessons Learned

FEWSNET was the brainchild of a member of the FEWS professional staff in Rosslyn. Subsequently, numerous other persons have impacted on the net in some way or another. Two professional telecommunications consultants have made significant contributions to expanding and refining the net, and to improving it's reliability. A part-time sysop spent many long (and often frustrating) months keeping the net running and adding new features to its operation and

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[37] At this writing, both A.I.D. and the FAO are beginning to explore satellite options for improving data and voice communications with Africa.

management. Several FEWS staffers also have been closely involved in the ***FEWSNET*** operation as well, including the training of new users and providing technical assistance until it was fully operational.

The ***FEWSNET*** experience has been very successful and can offer lessons to others interested in developing a similar net:

- Standardization - as you begin to plan and develop your net, try and standardize hardware/ software type and configurations, and training and operating procedures;

- Try and utilize communications professionals at the earliest stages of net planning. In the case of having only a part-time operator, establish a working relationship with a qualified consultant.

- Basic Net Function - decide early on the features you want to emphasize: sending and receiving messages, sending and receiving files (of all types), conference mail, or bulletin boards. Optimize your planning and set-up to ensure reliability for the chosen functions.

- Wherever possible, use dedicated phone lines and dedicated hardware with 24-hour operation. Anything short will contribute to less reliability and could result in higher overall operating costs.

- The bossnode or hub should have a full-time sysop for mission-critical implementation, especially where high traffic volume and difficult connect locations (e.g., Africa) are involved. An alternative would be to designate a staff member to serve as the sysop, recognizing that the task will often require a considerable amount of time.

4.1.4 Relevance of *FEWSNET* to Overall FEWS Operations

The FEWS project is unique in the intensity and, particularly, the scope of its data quest. The bread-and-butter of FEWS work is data accumulation and archiving. FEWS data cover an extraordinary range of disciplines, including:

. satellite-derived data on "greenness", rainfall, land use, cropped areas, etc.
. census and other demographic data
. market price data (on selected indicator items)
. agricultural data - cropped area, yield, production, storage, spoilage, etc.
. nutritional status and other health data
. transportation and communication
. food aid.

FEWSNET plays an important role in moving FEWS data quickly from one place to another.

Data Sourcing and Dissemination. Sources of needed data are often diverse and located outside the country under analysis: satellite-derived data is processed by NASA/Goddard (NDVI)[38]; cold-cloud duration data comes from the University of Reading in England[39]; the USGS/EDC supplies land-use data, digitized maps and overlays, etc.; and by the FEWS headquarters office, derivatives of the above, plus GIS overlays. In order to ensure comprehensive and timely analyses, it is necessary for the analyst(s) to have all available data readily available. Since most data used by FEWS is in machine-readable form, ***FEWSNET*** plays an important role in shuttling data back and forth.

The results of the analysis must be made widely available in order to be useful to decisionmakers. Again, ***FEWSNET*** plays an important role in disseminating these analyses as well as helping to support them.

FEWSNET **BBS.** The electronic bulletin board (BBS) component of ***FEWSNET*** allows anyone with a computer and modem to dial into the hub and exchange messages, scan available conferences, or download the *FEWS NEWS* hypertext application.

4.1.5 Future Uses of *FEWSNET*

While current use is most impressive, one area open to enhancement is the use of conference mail, i.e., messages pertaining to identified special interests. ***FEWSNET*** has made a few conferences available to all nodes, but use is limited as this feature matures.

As the overall system has now become more reliable and efficient, more time has been spent on developing conference mail capability in the following three areas identified at the November 1993 Nairobi FFR meeting:

. trip reports
. monthly reports
. vulnerability assessment methodologies.

Other possibilities for conference areas in the future include:

. technical support (computer, software)
. administrative support issues
. indicators
. news & happenings
. other related nets

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[38] **NDVI: normalized difference in vegetation index,** derived from the Advanced Very High Resolution Radiometer satellites (AVHRR) and usually aggregated to 7-square kilometer pixels.

[39] **CCD: cold cloud duration** estimates, derived from Meteosat -- an indicator of rainfall.

. Rainman (data manager)
. Agman (data manager)
. Prix (data manager)
. Popman or substitute (data manager)
. IDA (imagery display and analysis)
. GIS issues and techniques
. FEWS workshop issues (for upcoming workshops)

4.2 THE INTERNET

Much has been written about the information superhighway of the future. In one sense, it is here today in the form of the *Internet.* The concept and the backbone of this "network of networks" was built with USG funding (DoD and NSF), the concept being the creation of a high-speed data communications system capable of providing virtually anyone with a computer access to a wealth of information residing on computer networks worldwide and also providing messaging and file transfer capability. There are perhaps 30 million users of the net today, shooting messages and files to one another, participating in discussion groups, and combing the many on-line databases for technical and other information. A.I.D. has recently made access to the *Internet* possible for A.I.D. employees through a gateway installed on its extensive LAN system worldwide, and is in the process of exploring ways to effectively utilize this valuable resource. For FEWS, the *Internet* represents a mode of communication with hundreds of organizations and individuals worldwide, literally growing each day as new users sign on. Great as the potential of *Internet* may be, however, it is not without drawbacks. The net is not "user-friendly" at all, there is no overall "address book" of users, the addressing scheme is arcane and quite complex, there are several levels of "access" (not everyone has the same capabilities for file transfer or on-line functions), there is by definition no overall security or management structure, effective file transfer may take hours or days depending on the efficiency of the many *Internet* "providers", and access to the net is not yet uniformly available in the LDCs. Nevertheless, as some of these problems are resolved in the future, one can expect the *Internet* to become an increasingly valuable tool for FEWS communications.

4.3 THE FEWS AND A.I.D. LANs

In 1993 FEWS/Washington began using a LAN which linked together its many computers (about 20 as of early 1994). The LAN allowed each FEWS staff member to share messages and files easily with colleagues, and helped to free up space on each computer (always a problem with FEWS!) by having certain files reside on the server. (As of April 1994, FEWS is planning to put the entire historical imagery database on CD-ROM on the LAN server, so that any desired imagery can be accessed from any computer).

In addition to sharing files among headquarters personnel, an InterMail gateway has been installed on the LAN which allows messaging and file transfer between each computer and users of *FEWSNET* (the FFRs, Tulane, EROS, and others). Access to the *Internet* is also available from each computer on the LAN. This E-mail facility is used extensively.

A.I.D. currently has some 9,000 users on LANs worldwide, linked by various channels including the *Internet*. In 1992, FEWS began experimenting with a new interactive product for distributing basic news and information to A.I.D.'s Africa Bureau personnel via their LAN. This product, called *FEWSNEWS*, is updated every 10 days or so and provides any A.I.D. user with up-to-date summaries, including satellite imagery products, of the food security situation in FEWS countries. It is produced using an interactive hypertext tool (Bookmark) which allows the user to scan for desired information at varying levels of detail. This product has been extremely well received, and has pioneered a means of distributing voluminous information easily and effectively to A.I.D. users.

ANNEX: 1 *FEWSNET* Pointlist as of January 18, 1994

Headquarters Office, Rosslyn, Va. (1:109/173)

1:109/173 Marian Mitchell, Sahel/Horn Field Coordinator
1:109/173 Greg Gottlieb, Deputy Project Manager
1:109/173 Chuck Chopak, East & Southern Africa Field Coordinator
1:109/173 Beth Stanford, Office Manager
1:109/173 Graham Farmer, Climatologist
1:109/173 John McHarris, GIS Specialist
1:109/173 John Metzger, Operations Specialist
1:109/173 Sandeep Gupta, Communications Specialist
1:109/173 Sandra Kennedy, Secretary

Points in Field

1:109/173.22 Jerry Johnson, FEWS FFR, N'Djamena, Chad
1:109/173.23 Sy Hamady, Nouakchott, Mauritania
1:109/173.23 Kevin Sturr, FEWS FFR, Nouakchott, Mauritania
1:109/173.24 Mark McGuire, FEWS FFR, Niamey, Niger
1:109/173.24 Mesrak Yousoufou, Niamey, Niger
1:109/173.25 Felix Lee, FEWS FFR, Bamako, Mali
1:109/173.26 Karim Traore, Ouagadougou, Burkina Faso
1:109/173.26 Jeff Wright, FEWS FFR, Ouagadougou, Burkina Faso
1:109/173.27 Michelle McNabb, FEWS FFR, Nairobi, Kenya
1:109/173.27 Justin Wangila, Nairobi, Kenya
1:109/173.28 Kay Sharp, FEWS FFR, Addis Ababa, Ethiopia
1:109/173.29 Joe Dooley (USGS), Harare, Zimbabwe
1:109/173.29 Gary Eilerts, FEWS FFR, Harare, Zimbabwe
1:109/173.30 Lezlie Moriniere, FEWS FFR, Lilongwe, Malawi
1:109/173.30 Sam Chimwaza, Lilongwe, Malawi
1:109/173.31 Brad Flamm, FEWS FFR, Lusaka, Zambia
1:109/173.31 Lawrence Mungongaila, Lusaka, Zambia

Other *FEWSNET* Points

1:109/173.32 Mei Zhang, Knoxville, TN (transportation planning)
1:109/173.33 Bruce Ralston, Knoxville, TN (transportation planning)
1:109/173.34 Deven Koonjbearry, Tulane Univ. School of Public Health, New Orleans
1:109/173.38 Frank Riely, Tulane Univ., New Orleans, La.
1:109/173.39 Bill Trayfors, Washington, D.C.
1:109/173.40 Philip Kruss, Meteorological Service, Lusaka, Zambia
1:109/173.43 Don Moore, USGS EROS Data Center, Sioux Falls, S.D.
1:109/173.46 PRAGMA, Falls Church, Va.
1:109/173.60 Shawn Baker, Niamey, Niger
1:109/173.101 John Rook, WFP, Lusaka, Zambia.

Note: Several other points and persons at the above-listed points are contained in the actual pointlist, but those shown are the main players in ***FEWSNET.***

SECTION 5.0: FEWS REPORTS AND PRODUCTS

Effective dissemination of FEWS information products is an important component of the project's work. FEWS produces a number of published reports, including: bulletins, occasional papers, on-line documents, and numerous ad-hoc products. Regularly scheduled reports, including the cable-form FSOC, are intended to meet identified needs for periodic updates on developing food security situations in Africa. From time to time the project publishes technical reports on one or another aspect of its work, including vulnerability assessment, meeting reports, concept papers, etc. This section explores the types of reports and products produced in relation to their intended purposes.

5.1 REPORTS

5.1.1 FEWS Bulletins

Issued every ten days during the agricultural season, the *FEWS Bulletins* are a one page (two-sided) analytical synopsis of current information in the FEWS countries. The bulletins provide timely information on the growing season's progress, i.e., any information pertaining to and influencing crops such as rainfall data, pest/insect management, crop production, grain price indices, etc., and how these combined factors may influence food security for populations at risk. The Bulletins also include material informally reported by the FFRs on a 10 day basis. Initially, this reporting was done by FAX; however the reporting is now done by E-Mail. Data are arranged regionally and/or by country, and are mapped and displayed graphically in color, with accompanying succinct narratives (ANNEX 1).

The *FEWS Bulletin* is a popular product among policy-makers in AID/W. The FEWS readership Survey conducted in 1990[40] found that, in contrast to the trimestral reports and the FSOCs, *FEWS Bulletins* are "always" read by Division and Branch Chiefs, Desk and Project Officers. Valued for their "brevity and conciseness", and their focus on "the important issues", the *Bulletins* have had an effect on the decision-making process: 56 percent of all survey respondents stated that the *Bulletins* had an impact on resource allocation.

5.1.2 Trimestrals

The trimestral reports are the consolidated FEWS region-wide reports published by FEWS/W three times a year, using detailed country-specific data submitted by the FFRs. These are the pre-growing season *Vulnerability Assessment* published in June, the mostly qualitative *Preharvest*

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[40] A large-scale readership survey is underway in April 1994, covering all recipients of FEWS publications. This survey will provide important insights not now available, especially on new FEWS products such as *FEWS NEWS*.

Assessment of Cereal Production published in October, and the more quantitative *Harvest Assessment of Cereal Production* issued in January. The purpose of the trimestrals is to provide combined country-specific profiles regarding food security and populations at risk.

5.1.2.1 *Vulnerability Assessment*

FEWS' multidisciplinary approach requires a model that integrates the variety of data within a consistent conceptual framework. This framework, in addition to allowing FEWS personnel to use the same terminology, monitor project progress, and define areas for further examination, serves to combine the different data and information streams relating to populations at risk and food security. The concept of "vulnerability" has been identified by the FEWS project as an organizational paradigm in which FEWS activities can be presented and understood. Vulnerability is a relative term describing the level of susceptibility of people to food insecurity.[41]

In FEWS usage, vulnerability is characterized by its degree: slight, moderate, high, or extreme. Extreme is synonymous with "at risk", i.e., populations either currently, or in the near future, expected to have insufficient food or resources to acquire food, to avert a progressive deterioration in health or nutrition. The concept of vulnerability is dynamic in that it incorporates current and chronic conditions. Current vulnerability highlights short-term changes in food security status and its effects; the latter involves long-term conditions that predispose a specific group or region to food insecurity. Vulnerability analysis includes three levels of inquiry: food availability, food access, and food utilization. These levels are linked by the model that interprets all relevant information for its food security impact on the diversified income generating possibilities of different groups of households.

FEWS *Vulnerability Assessment* reports contain an executive summary, followed by a regional synopsis, and country-specific analyses on chronic and current conditions. These analyses include the methodology used to compile the information, an examination of the socioeconomic groups, and conclusions. The text is complimented by maps, tables, and graphs.

5.1.2.2 *PreHarvest Assessment*

Whereas the *Vulnerability Assessment* spotlights specific populations and their susceptibility to food insecurity, the *Preharvest Assessment* is a qualitative assessment of the harvest underway, focusing on the factors affecting food availability and access. Factors influencing food availability cover the full spectrum of agriculture -- from rainfall and other weather conditions to irrigation fed crops and pest management, from food stocks and flows to pastoral conditions. Food access considerations include economic data on cereal prices, projected food consumption

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[41] May, Charles Alan. "Vulnerability and Food Security in the FEWS Project: Guidelines for Implementation." FEWS Working Paper, April 1990.

needs, and a vulnerability update. Given the existing conditions, the *Preharvest Assessment* predicts or forecasts what a situation might be once the harvest is complete. The *Preharvest Assessment* reports include an executive summary, a regional synopsis, and specific country analyses. Maps, tables, and graphs accompany the text.

5.1.2.3 *Harvest Assessment*

Like the *Preharvest Assessment*, the *Harvest Assessment* concentrates on those factors affecting food availability and access. The report recaps the actual harvest outcome of the harvest in terms of production, pastoral conditions, food stocks, projected food aid and commercial imports and exports. Food consumption needs are forecasted, an economic analysis on cereal prices is provided, as well as an update on vulnerability. As with the above reports, the *Harvest Assessment* includes an executive summary on each FEWS country, a regional synopsis, and specific country analyses. Maps, tables, and graphs accompany the text.

5.1.3 FSOCs

As the locus of country-level analysis shifted from Washington to the field at the start of FEWS II, and as USAID Missions were tasked with regular reporting on food security, monthly country-specific Food Security Operations Cables (FSOC) were initiated for Mauritania, Mali, Burkina Faso, Niger, Chad, and the Sudan. These follow a uniform reporting format, and are sufficiently detailed as to obviate the need for monthly country reports such as were produced by FEWS in Phase I. Generated in the field by the FFRs and Mission staff, these cables contain current information relating to food security. The FSOCs are routed to key persons in the appropriate Bureaus and offices within AID/W, as well as to the FEWS/W staff around the 15th of each month. While keeping AID/W decisionmakers abreast of the most current information, the FSOCs are also used by the FEWS staff in Washington to publish the periodic FEWS Bulletins. They also are the basis for the trimestral reports. A sample FSOC is shown in ANNEX 2.

Among the three groups of respondents -- Division and Branch Chiefs, Desk and Project Officers, and Analysts and Economists -- interviewed for a FEWS Readership Survey in 1990, the second group utilized the FSOCs most often in their work. Valued for their detail of information, more than 90 percent of the Desk and Project Officers surveyed said that these cables had entered into their decisionmaking process at one time or another, and had been used to justify resource allocations. FSOC sections that are most useful to all respondents include the summary, food deficit estimates and at-risk population statistics. Data on crop forecasts, food stress, and information concerning displaced persons are also considered useful.

5.2 FEWS NEWS

When the FEWS contract was amended in 1992 to add four countries in Southern Africa, there was no formal reporting requirement similar to those of the Sahel FEWS countries. However, over time FEWS began receiving numerous ad-hoc requests for updates on the emerging food situation in those countries. The FEWS coordinator responsible for Southern Africa initiated a series of situational updates using an on-line hypertext report for A.I.D. managers, complete with graphics and NDVI imagery products. *FEWS NEWS* was created as a user-friendly on-line product designed to make the most current information quickly accessible to anyone on A.I.D.'s LAN. Soon after its trial run, *FEWS NEWS* was expanded to include information on all FEWS countries, by incorporating the text and graphics used in FEWS Bulletins. Although originally intended to serve the needs of the Africa Bureau and OFDA, *FEWS NEWS* can be accessed by anyone having access to the Africa Bureau's LAN (approximately 9,000 persons worldwide).

FEWS NEWS is an interactive text product (hypertext) designed for easy and quick access to a range of text information and graphic files. *FEWS NEWS* includes: an Introduction (instructions on the hypertext product); Regional Highlights (latest FEWS Bulletins and NDVI data for Southern Africa, the Sahel, and the East Africa region); National Highlights excerpts; and, the *FEWS NEWS* Archive (three months of FEWS Bulletins, three dekads of NDVI images, and three months of weather updates). There is also a section listing FEWS Working Papers. *FEWS NEWS* also contains information on countries that are not necessarily monitored by FEWS. These data are presented in bullet style "flashes" designed to keep policymakers abreast of potential drought and other crises in countries that border FEWS monitored countries or are of regional interest. Like the FEWS Bulletins, *FEWS NEWS* is updated every 10 days.

Dissemination. The concept and implementation of *FEWS NEWS* continues to generate interest outside of AID/W. By request, a demonstration copy has been sent to the Office of the Vice President, the Carter Center (Atlanta), Oxford University (England), several outside agencies, and several A.I.D. overseas missions. *FEWS NEWS* is also available in electronic form on the Internet (by anonymous FTP from vita.org) and via the ***FEWSNET*** BBS.

5.3 COUNTRY MANUALS

Compiled by the FEWS FFR and updated each year, Country Manuals are a resource "how-to" guide for early warning activities in a country-specific setting. The manuals contain background information on the history of famine and affected populations, early warning and FEWS in each country, as well as a description of current early warning activities by FEWS and other donor organizations, data sources, and methodologies for conducting vulnerability, pre-harvest, and harvest assessments. Administrative issues such as the FSOCs, reports to FEWS/W, facility management, communications with FEWS/W via E-mail, in-country distribution of FEWS reports, travel and accounts are also included. The Country Manuals also provide a guide to the role and responsibilities of the FFR. A sample of a Country Manual outline is in ANNEX 3.

5.4 WORKING PAPERS

FEWS working papers are issued periodically on topics of general interest. They tend to group around the overall issue of vulnerability, and its measurement. Papers published during the past few years include the following:

May, Charles A., "Vulnerability and Food Security in the FEWS Project: Guidelines for Implementation," April 1990.

Marzilli, Jeffrey P., "Early Development of the 1990 Meher (Main) Agricultural Season in Ethiopia," August 1990.

Downing, Thomas E., "Assessing Socioeconomic Vulnerability to Famine: Frameworks, Concepts, and Applications", January 1991.

Daly, Denise N., "FEWS Readership Survey," April 1991.

May, Charles A., "Market Information Systems (SIM) in Chad: Issues and Proposals,", May 1991.

Fattori, Thomas R., "Income Diversification in Mali: Analysis and Methodology for Vulnerability Assessment,", June 1992.

May, Charles A., "Price Data in a Famine Early Warning System," September 1992.

These and other FEWS papers are available on request.

5.5 AD HOC PRODUCTS AND REPORTS

FEWS/W receives numerous requests for additional information from various offices and bureaus within the Agency and its overseas Missions, as well as the news media, PVOs, NGOs, universities, unilateral and multilateral organizations, and a host of other sources. Some requests are fairly simple to answer while others require a significant amount of data processing, such as special analyses of events about to take place. The following is a partial listing of Ad hoc requests FEWS received between June 1993 and April 1994:

University of Arizona, Arid Lands Center - Discuss FEWS project;

IFPRI - Review of FEWS project;

USG Agency - Discussion of NDVI for Somalia;

Tulane University - Graphic w/NDVI and Meteosat coverage of Mali through 1992;

Office of Population (AID) - Discussion of FEWS vulnerability methodology and its applicability to population carrying potential;

USG Agency - Transfer of NDVI HA archive from backup tapes to Bernoulli 90 MB disks;

OFDA/PMP - Discussion of FEWS and Vulnerability Analysis;

World Bank - FEWS demonstration;

DMTS Corporation - Faxed specific FEWS Bulletins (interested in locusts);

AFDA - Copies of Vulnerability Assessments, FEWS Bulletins for Ethiopia;

Arizona State University - FEWS demonstration, discussion of NDVI and vulnerability methodology;

University of Quebec - Sent samples hypertext including FEWS NEWS

CELADE - Sent copy of FEWS NEWS for demonstration;

University of Arizona - IDA graphic, Ethiopia;

Winrock/ILRAD - Discussion on GIS and data;

Scott AFB - FEWS Bulletins;

Center for Naval Analysis - 1993 FEWS Bulletins, Preharvest, Harvest, Vulnerability Assessment, Downing Summary;

University of Kansas - Harvest/Preharvest/Vulnerability Assessment, 1993;

CDC - June 1993 Vulnerability Assessment;

ODI, London - Historical trend rainfall data for Ethiopia;

OFDA/DRD - Copy of enlarged map for Sudan;

Johns Hopkins University - Bulletins, Trimestrals;

World Vision - Recent Bulletins, trip reports, anything in relation to Ethiopia, Sudan, Somalia, Kenya;

Washington Post/Washington Times/New York Times - Sent packets of Bulletins, reports from 1993 to present.

FEWS BULLETIN

USAID Famine Early Warning System

June 10, 1994
SA-16

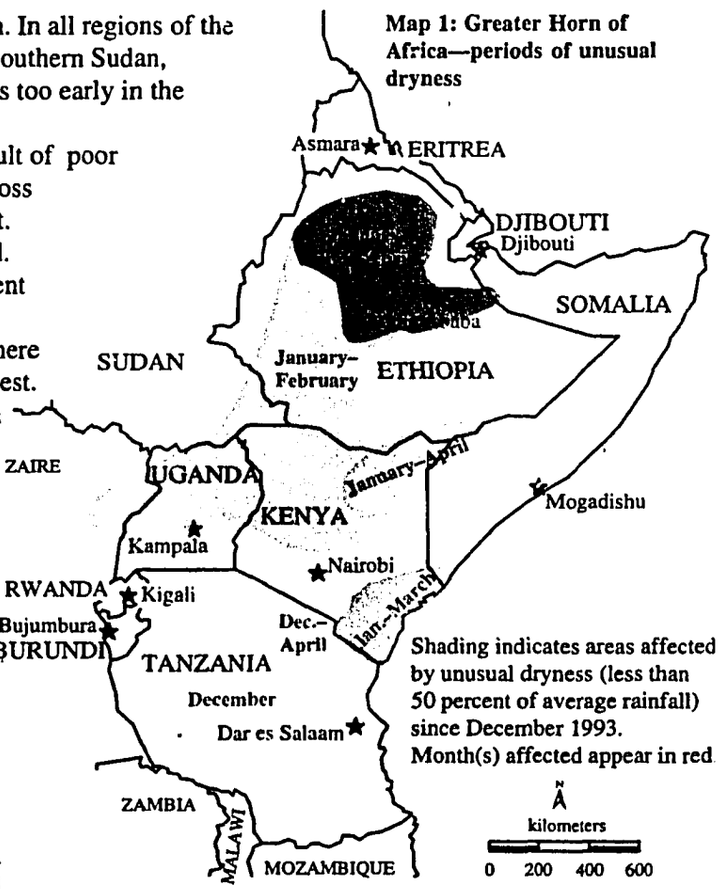
Greater Horn of Africa current season: Mixed prospects throughout the region

This update covers prospects for the current agricultural season. In all regions of the Horn that are currently in the midst of an agricultural season (southern Sudan, Ethiopia, Somalia, Kenya, Uganda, Rwanda, and Burundi), it is too early in the season to forecast the harvest outcome.

Food insecurity of households continues to increase as a result of poor 1993/94 harvests, inadequate rainfall (January–April 1994) across many significant production areas (see Map 1), and civil unrest.

Production prospects for the ongoing rainy season are mixed. In Ethiopia, the short (*belg*) rains started too late, causing current (secondary) harvest prospects to be well below average—and in some areas nil. In all greater Horn countries there are areas affected by localized drought conditions and civil unrest. In the major agricultural areas of Kenya, Uganda, and southern Somalia, current agricultural production prospects are average to slightly above-average as a result of adequate rainfall (see Map 2). In southern Sudan, Rwanda, and Burundi, harvest prospects are limited due to disruptions caused by civil insecurity, although rainfall has recently been average to slightly above-average.

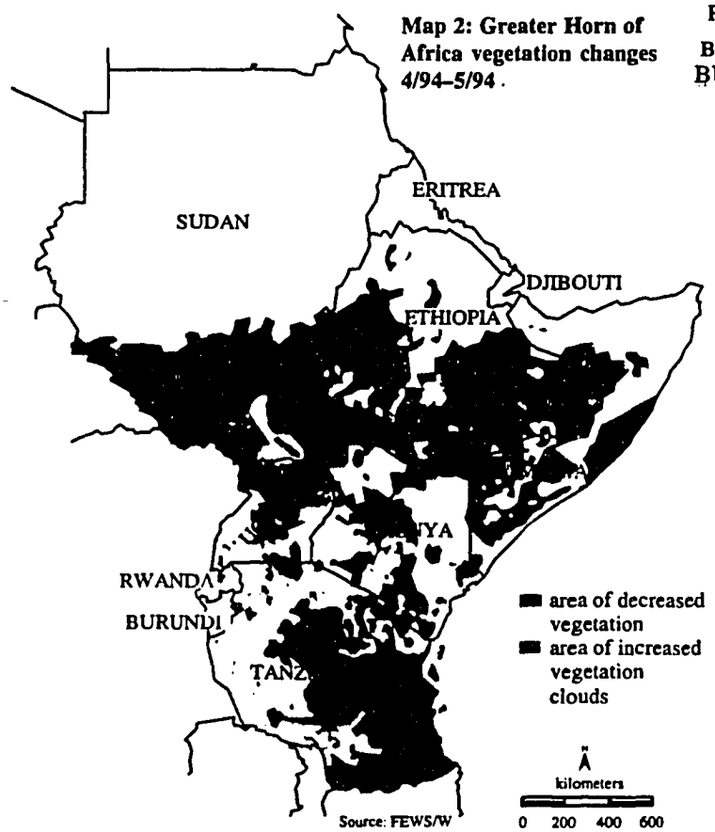
Map 1: Greater Horn of Africa—periods of unusual dryness



Shading indicates areas affected by unusual dryness (less than 50 percent of average rainfall) since December 1993. Month(s) affected appear in red

Source: FEWS/W,JAWF,NOAA/USDA Joint Agriculture/Weather Facility

Map 2: Greater Horn of Africa vegetation changes 4/94–5/94.



Source: FEWS/W

Source: FEWS/W,NASA,GAC,NDVI

Agricultural seasons are beginning in northern Sudan (late May), northeastern Ethiopia (June), and will start later in Eritrea (July) and Tanzania (October). There is no cereal production in Djibouti.

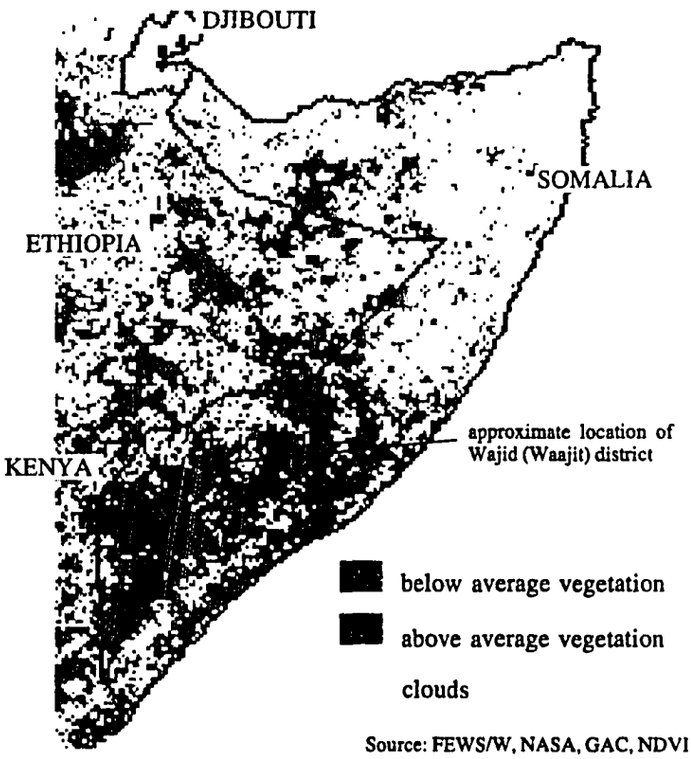
Production from upcoming harvests should have some impact on the food security situation facing many Horn populations. In Ethiopia, southern Sudan, Kenya, Somalia, Rwanda, and Burundi, timely food aid distributions are essential to avert worsening food security and vulnerability.

Somalia update: Above-average vegetation indicated in most agricultural areas

Rainfall levels continue to be greater than average in the agricultural areas of central and southern Somalia, resulting in above-average vegetation (see Figure 1). The timing and abundance of this season's rains have provided excellent soil moisture for crop germination and growth. The combination of good rainfall and people returning to their areas of residence from displacement camps has contributed to an increase in area planted compared to last year. Still, a seed shortage is the most important factor constraining further expansion of cropped area. Although the United Nations and NGOs have made great efforts to distribute seeds, there are some areas without seeds. An FAO/WFP assessment team estimates that despite the above-average vegetative growing conditions, the current *gu* (main) season will result in a national production of only 117,000 MT, or about one-quarter of average pre-civil war production levels and 68 percent greater than last year's *gu* harvest..

Although the current season appears to be progressing well, food shortages as a result of last year's harvest shortfall are increasing household vulnerability to food insecurity. For example, a recent Concern–Ireland report said there is a general food shortage in Wajid (Waajit) District (north of Baidoa) which could negatively impact this season's harvest. As food stocks run out, households will have to expend greater effort to search for food prior to harvest.

Figure 1: Somalia: NDVI difference from average (1982–1990) for late May



Source: FEWS/W, NASA, GAC, NDVI

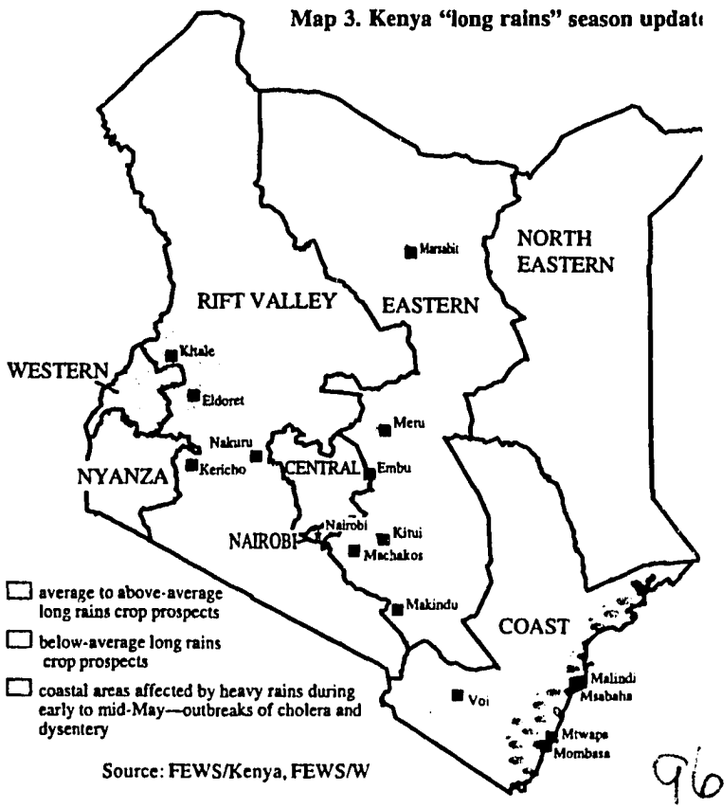
Kenya update: "Long rains" season progressing well

The "long rains" growing season appears to be progressing well in the high-potential maize producing areas. Rains were delayed in some arid and semiarid districts of Eastern and Rift Valley provinces, while coastal areas have received heavy rains—prompting the outbreak of cholera and dysentery (see Map 3).

In the high-potential agricultural areas, cumulative rainfall has ranged from average to above-average since the start-of-season. Vegetation continues to develop. If current conditions continue, maize harvest prospects should range from average to slightly above average in those areas (see Map 3).

The onset of the "long rains" was delayed (late April) across the more arid Eastern and Rift Valley provinces. Some parts of Eastern Province—areas around Kitui, Mwingi, and Makueni—have experienced erratic rainfall and crops are experiencing water stress. However, pastures are flourishing in areas where rainfall has been more consistent.

Map 3. Kenya "long rains" season updat



Source: FEWS/Kenya, FEWS/W

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Malawi update: Preliminary outcome of the FAO/WFP assessment mission

A WFP/FAO Crop and Food Supply Assessment Mission visited Malawi from May 8 to 16, to review estimates of the 1994 cereal production, assess the food supply situation, and forecast Malawi's food import and food aid requirements for 1994/95.

Although 1993/94 maize production was below average, the amount of carryover stocks is larger than in 1992/93, following the drought. ADMARC carryover stocks into the 1994/95 marketing year are estimated at 110,000 MT, and the strategic grain reserve holds approximately 180,000 MT. Little information is available concerning on-farm stocks, but estimates are in the range of 10,000 and 50,000 MT.

Eight RDPs in the Center and Southern regions have been identified as requiring an emergency food aid program (see Map 4). It is estimated that within these RDPs, about 85 percent of farm families will require assistance.

The worst affected RDPs are Lilongwe East, Lilongwe West, Bwanje, Ntcheu, Mangochi, Salima, Balaka and Kawinga. Two RDPs, Phalombe and Namwera, have been less seriously affected. A large number of farmers in affected areas have harvested amounts of less than half of their normal crop, to almost nothing. The total population estimated to be seriously affected is approximately 3 million; the maize relief requirements are estimated at 175,000 MT.

Map 4. Malawi RDPs where farm families require food aid assistance —population affected = nearly 3,000,000

Sources: FEWS/Malawi, GOM, WFP, FEWS/W

Country Reports

MALAWI

- Some locales within Northern and Southern provinces have received late rains Nkhata Bay, Chinteche (in Nkhata Bay), Mzuzu, Lujeri (in Mulanje), Chikangawa (in Mzimba). Central Province has not received any rain for the last two dekads (10-day periods).
- Seasonal cumulative rainfall levels indicate that most of Southern and Central provinces, and areas around Chitipa and Karonga RDPs, have received 50–75 percent of normal rainfall. During the recent agriculture season a greater part of the Northern Province received 75–100 percent of normal rainfall. Areas that received greater than 100 percent of normal cumulative rainfall exist around Mwanza Boma and KFCTA–Kasungu. Areas that recorded below 50 percent of normal cumulative levels exist around Mangochi. Notable cumulative totals are Lujeri (in Mulanje) 1,420 mm, Mimosa (Thyolo) 1,256 mm, Mwanza Boma 1,195mm in Southern Province; Nkhotakota 980 mm, Kasungu 906 mm, Lifuwu (in Salima) 879 mm in Central Province; Nkhata Bay 1,115 mm, Chikangawa (in Mzimba) 1,045 mm in Northern Province.
- Planting of some winter crops (2nd plantings of maize, beans, and peas) in the *dimbas* (lowlands) and along river beds is underway. This is a common practice in Ngabu ADD, Blantyre-Shire Highlands, Salima ADD, Mchinji, Dowa East, and Ntchisi RDPs and, to a lesser extent, all other RDPs. Some areas have been affected by the lack of residual moisture from the poor main season rains.
- This year the Tobacco Association of Malawi (TAMA) negotiated with tobacco buyers to quote prices in US$, as opposed to Malawian Kwacha, to help protect farmers from any drop in the value of the Kwacha. Average price = US$1.25 for flue cured tobacco and US$1.45 for burley tobacco.
- ADMARC continues to have adequate stocks of maize at all of it's selling points.

ZAMBIA

- The April report of the Household Food Security, Nutrition and Health Monitoring System indicates that rural populations in several districts in Eastern and Southern provinces have very low stocks of staple food. Nearly 100 percent of surveyed communities have a less than one month supply of staples in Mazabuka District, and over 50 percent have a less than one month supply in Kalomo, Monze, Siavonga and Sinazongwe districts (all in Southern Province). In Eastern Province,

continued on page 4

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92 percent of surveyed communities in Chama District have a less than one month supply, while Chipata and Lundazi districts surveys reported more than 50 percent of surveyed communities with less than a one month supply. Districts in Luapula and Northwestern Provinces (high production zones for cassava), report very few communities with a less than one month supply of staple food. Only Nchelenge and Samfya districts reported a significant percentage (25 percent). Note: the Household Food Security, Nutrition and Health Monitoring System reports on half of Zambia's provinces each month; Western, Central, Lusaka, Copperbelt and Northern provinces will be covered in the May report, issued in early June.

- African Migratory Locusts (near swarming stage) have recently been sighted in parts of southern Tanzania (Malagarasi, Wembere, and Rukwa Valley). Additionally, small outbreaks of Red Locusts have been spotted near Kawambwa in Luapula Province, and in the Kafue River Flats in Namwala District (Southern Province).
- Prices for a 90 kg bag of maize ranged between K6,000 to K9,000 (about US$ 8.50 to 13.00) in Southern Province to K9,000 to K12,000 (about US$ 13.00–17.50) in Northwestern Province.
- Recent economic data from the Central Statistics Office (CSO) report the annual inflation rate for 1993 was 187.1 percent, just slightly lower than 1992's inflation rate of 191.3 percent. Inflation rates for the second half of 1993 were lower than for the first half, declining from over 15 percent in June to nil in November. Inflation rates rose again during the first months of 1994: 4.1 percent in January and 6.1 percent in February.
- CSO reports also indicate a real Gross Domestic Product (GDP) increase of 4 percent in 1993, the first time in five years that GDP growth has exceeded the estimated population growth rate of 3.2 percent.

ZIMBABWE

- The Government recently announced that all 11 parastatals reporting to the Ministry of Lands, Agriculture, and Water Development will be commercialized by July 1, 1994. These include the Grain Marketing Board, the Cotton and Tobacco Marketing Boards, the Dairy Marketing Board, the Agricultural Finance Authority, the Cold Storage Commission, and the Agricultural Development Authority.
- Sub-national details of this year's agricultural production have still not been released by AGRITEX, hampering assessments of food security across the country.

ETHIOPIA

- During mid-May most of the country experienced significant rainfall of fairly wide distribution. This has lessened fears of a delay in land preparation and sowing of *meher* (main season) crops caused by delayed and insufficient *belg* (secondary season) rains.
- Insufficient rainfall continues to affect areas within a narrow corridor through the central part of the country, beginning in the northeast and stretching south through central, northeastern, and eastern parts of Tigray and joining the northern parts of Region 2 (Afar). This arid zone spreads south through a few parts of central and southern Region 3 (Amhara). This poses a danger to some *belg* producing areas of S. Wello and N. Shewa zones, while hampering work on *meher* (main) season crop preparations.
- Parts of Arsi and Bale zones of Region (Oromia) remain very dry. The *belg* seaso is already a failure in Arsi. In Bale, a rel tively good start for *belg* season crops h been affected by an untimely dry spell.
- **Armyworm outbreak**—CARE–Ethiopi reports severe infestations of armywor in Babille and Funiyan Birra areas Eastern Harerghe. The Desert Locust Co trol Organization for Eastern Afric attributes the outbreak to migration of th nocturnal moth *Spodoptera exempta* fro Kenya and Tanzania where outbreaks o curred earlier in the year. A recent surve revealed infestation of over 200 hundre worms per square meter around Babill Infestations appeared to be even worse i the Funiyan Birra area near Jijiga. Far ers are reluctant to sow precious seeds f long-cycle *meher* crops until the pests a eradicated.

KENYA

- See Page 2.

SOMALIA

- A recent census, compiled from UNDP, WF UNICEF, and SCF-UK reports, estimat there are more than 350,000 internally di placed people in Somalia. Over 240,000 a living in and around Mogadishu.
- In Mogadishu, grain prices are rising due t renewed civil unrest.
- Many irrigation canals in Juba and Shebell regions are damaged (severed or silted Favorable water levels from abundant rai cannot be utilized without maintenance an reconstruction.

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FEWS BULLETIN SA–16
June 10, 1994

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SUBJECT: FEWS/NIGER: FOOD SECURITY OPERATIONS CABLE, FEBRUARY, 1994

REF: (A) 93 NIAMEY 8721, (B) NIAMEY 00869,
(C) NIAMEY 00442

1. THIS IS THE NIGER FSOC FOR FEBRUARY, 1994.

2. BEGIN TEXT

I. SUMMARY

- THE GOVERNMENT OF NIGER (GON) IS STILL WAITING FOR THE DONOR COMMUNITY TO RESPOND TO THEIR REQUEST FOR 55,000 METRIC TONS OF EMERGENCY FOOD AID. THE HARDEST HIT AREAS ARE IN THE OUALLAM, TAHOUA, BOUZA, FILINGUE, AND GOURE ARRONDISSEMENTS, AND THE ENTIRE DEPARTMENT OF AGADEZ. FIELD MISSIONS AND SURVEYS ARE BEING CONDUCTED TO ASSESS THE CURRENT FOOD SECURITY SITUATION AND ALSO TO MONITOR PRICES AND THE GENERAL EFFECTS OF THE RECENT DEVALUATION AND CHANGES IN EXCHANGE RATE AND EXPORT POLICIES IN NIGERIA. REPORTS FROM THESE MISSIONS SHOW CEREAL AND ANIMAL PRICES HAVE INCREASED BY AN AVERAGE OF 40 PERCENT SINCE DEVALUATION. THE RISING COSTS OF CEREALS AND OTHER BASIC GOODS ARE REDUCING THE PURCHASING POWER OF THE GENERAL POPULATION. SOME EVIDENCE SUGGESTS STABILIZATION OF PRICES BUT THIS IS FAR FROM CERTAIN.

II. HARVEST UPDATE

- AS REPORTED IN THE DECEMBER POST-HARVEST REPORT (REF A), 20 OF THE 35 ARRONDISSEMENTS ARE NOT EXPECTED TO MEET CONSUMPTION REQUIREMENTS BASED ON THE 1993/94 CEREALS PRODUCTION (RAINFED MILLET AND SORGHUM). A

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REQUEST WAS MADE BY THE GOVERNMENT OF NIGER (GON) FOR 55,000 METRIC TONS OF EMERGENCY ASSISTANCE. USAID/NIGER HAS REQUESTED 15,000 METRIC TONS TO ASSIST WITH THIS REQUEST.

- THE DISTRIBUTION PLAN FOR THIS EMERGENCY ASSISTANCE, WHICH WAS PREPARED BY NIGER'S EARLY WARNING SYSTEM OFFICE (SAP), IS BASED PRIMARILY ON TWO INTER-RELATED FACTORS: THE CEREALS BALANCE (PRODUCTION MINUS CONSUMPTION NEEDS) AND A VULNERABILITY INDEX FOR EACH ARRONDISSEMENT AS DETERMINED BY THE PARTICIPANTS OF THE NATIONAL SAP CONFERENCE IN MARADI IN DECEMBER 1993. THE SAP INDEX IS BASED ON SEVERAL FACTORS, INCLUDING: THE AGRO-PASTORAL SITUATION, CEREAL AND ANIMAL MARKETS, HEALTH AND NUTRITION, AND OTHER SOCIO-ECONOMIC VARIABLES. IF A GIVEN ARRONDISSEMENT WAS DETERMINED TO BE DEFICIT BASED ON THE CEREALS BALANCE, THEN THE ALLOCATION OF EMERGENCY ASSISTANCE WAS WEIGHTED ACCORDING TO THE VULNERABILITY INDEX FOR THAT ARRONDISSEMENT.

- THEREFORE, THE AMOUNT OF EMERGENCY ASSISTANCE REQUESTED IS A RELATIVE INDICATOR OF THE DEGREE OF VULNERABILITY USING THE SAP METHODOLOGY. USING THIS CRITERION, THE ARRONDISSEMENTS TO WATCH ARE: OUALLAM (GREATER THAN 5000 METRIC TONS REQUESTED); BOUZA, TAHOUA, ARLIT (4000 TO 5000 MTONS REQUESTED); TCHIROZERINE, FILINGUE, MYRRIAH (3000 TO 4000); AND TERA, DAKORO, MAINE SOROA (GREATER THAN 2000). OTHER ZONES WHICH HAD ESPECIALLY LOW PER CAPITA PRODUCTION OR A HIGH VULNERABILITY RATING BUT WHICH REQUESTED LESS THAN 2000 METRIC TONS OF EMERGENCY AID INCLUDE: GOURE, N'GUIGMI, DIFFA, AND ILLELA ARRONDISSEMENTS.

- FIELD MISSIONS ARE CURRENTLY UNDERWAY AND OTHERS ARE PLANNED TO VERIFY THE STATUS OF THESE DEFICIT ZONES AND ASSESS THE CURRENT SITUATION.

III. MARKET/ECONOMIC ANALYSIS

- EVERYONE IS KEEPING A WATCHFUL EYE ON THE ECONOMIC SITUATION FOLLOWING THE DEVALUATION OF THE CFA IN JANUARY AND CHANGES IN EXCHANGE RATES AND EXPORT POLICIES IN NIGERIA. SEVERAL STUDIES ARE UNDERWAY TO SYSTEMATICALLY MEASURE THE PRICES OF A WIDE VARIETY OF CONSUMER ITEMS.

A. CEREAL AND LIVESTOCK MARKETS

- PRIOR TO DEVALUATION, THE NATIONAL CEREAL MARKET INFORMATION SYSTEM (SIM) INDICATED THAT MILLET PRICES WERE FOLLOWING THEIR NORMAL ANNUAL CYCLE, RISING SLIGHTLY (5 TO 10 PERCENT) IN DECEMBER FROM AN ANNUAL LOW IN NOVEMBER. HOWEVER, RECENT STUDIES MONITORING THE EFFECTS OF DEVALUATION SHOW A DRAMATIC INCREASE WHEN COMPARING CEREAL PRICES BEFORE AND AFTER DEVALUATION (AN AVERAGE OF OVER 40 PERCENT). THE TABLE BELOW GIVES THE PRICES FOR MILLET, CORN, RICE, AND COWPEAS FOR THREE MARKETS (UNITS ARE FCFA PER SACK, USUALLY 50KGS; PERCENT

CHANGE IS 1 FEB COMPARED TO 11 JAN, BASED ON STUDIES BY THE MINISTRY OF FINANCE (MFP) AND USAID/NIGER PROGRAM OFFICE). NO ONE KNOWS HOW LONG THIS TREND WILL CONTINUE

BUT THE INCREASED PRICES ARE ALREADY EFFECTING PEOPLES' ABILITY TO PURCHASE THESE BASIC COMMODITIES. THIS EFFECT WILL BE MOST CRITICAL IN THOSE AREAS WHICH WERE ALREADY CEREAL DEFICIT AND IN NEED OF EMERGENCY FOOD ASSISTANCE.

ZINDER

PERCENT

	11-JAN	17-JAN	1-FEB	CHANGE
MILLET	4000	4500	6000	50.0
CORN	4000	4500	5500	37.5
RICE	8500	9000	10500	23.5
COWPEAS	8000	11000	14000	75.0

DIFFA

PERCENT

	11-	JAN	17-	JAN	1-	FEB	CHANGE
MILLET	3500		4000		5000		43.0
CORN	3000		4000		4000		33.3
RICE	6000		6500		8125		35.4
COWPEAS	8700		11500		13000		49.4

MARADI

PERCENT

	11-JAN	13-JAN	1-FEB	CHANGE
MILLET	4500	4500	5750	27.8
CORN	3500	4500	5000	42.9
RICE	8500	9500	12500	47.1
COWPEAS	8000	10500	13500	68.8

- WITH RESPECT TO SLM LIVESTOCK PRICES (ADULT MALE GOATS), DECEMBER 1993 PRICES (BEFORE DEVALUATION) WERE GENERALLY LOWER THAN BOTH THE AVERAGE (1988-93) AND WHEN COMPARED TO DECEMBER 1992. HOWEVER, RECENT OBSERVATIONS FROM FIELD TRIPS ALONG THE NIGERIA BORDER INDICATE THAT LIVESTOCK PRICES BEFORE AND AFTER DEVALUATION SHOW SIGNIFICANT INCREASES - BETWEEN 50 AND 100 PERCENT (SEE SEPTEL, THIS DATE).

B. UPDATE ON DEVALUATION

- THE IMMEDIATE EFFECT OF DEVALUATION ON LOCAL CONSUMERS WAS MOST NOTICEABLE WITH REGARDS TO BASIC COMMODITIES SUCH AS COOKING OIL, SUGAR, AND TOMATO PASTE (BASED ON STUDIES BY MFP AND OTHERS WHO ARE TRACKING PRICES IN VARIOUS MARKETS AROUND THE COUNTRY). THESE ITEMS INCREASED 30 TO 50 PERCENT IMMEDIATELY AFTER DEVALUATION, WHEREAS CEREAL PRICES HAD ONLY INCREASED AROUND 15 TO 20 PERCENT. HOWEVER, SINCE THE INITIAL INCREASE, THE BASIC COMMODITIES HAVE STABILIZED (AT THE ELEVATED LEVELS) BUT CEREAL AND ANIMAL PRICES CONTINUE TO RISE (AS DISCUSSED ABOVE).

- SEVERAL CABLES HAVE BEEN DISTRIBUTED BY THIS POST DESCRIBING THE CURRENT SITUATION RELATIVE TO THE RECENT DEVALUATION (E.G., REFS B AND C, AND SEPTEL, THIS DATE). FOLLOWING THE INITIAL SHOCKS, ANALYSTS ARE NOW BEGINNING TO EVALUATE THE POSITIVE SUPPLY-SIDE RESPONSES THAT DEVALUATION IS INTENDED TO SUPPORT, SUCH AS: INCREASED COMPETITIVENESS, EXPANDED INDUSTRIAL PRODUCTION, AND IMPORT SUBSTITUTION.

IV. FOOD STOCK/ASSISTANCE INFORMATION

- AS OF JANUARY 31, 1994, THERE WERE APPROXIMATELY 45,000 MT OF MILLET IN THE GON SECURITY STOCK. THE NATIONAL CEREALS MARKETING BOARD (OPVN) IS IN THE PROCESS OF BUYING STOCK TO REPLENISH THE RECOMMENDED LEVEL OF 80,000 MT. AN ADDITIONAL 12,200 MT OF RICE WERE IN STOCK WITH THE RICE PARASTATAL AND THE NATIONAL FLOUR MILL HELD 1,000 MT OF WHEAT. DONOR STOCKS HELD BY THE WORLD FOOD PROGRAM (WFP) TOTALED APPROXIMATELY 7,000 MT OF MILLET AND SORGHUM AND 2,400 MT OF VARIOUS COMMODITIES.

3. ACRONYMS AND ABBREVIATIONS USED:

- FSOC: FOOD SECURITY OPERATIONS CABLE
- SIM: NATIONAL CEREAL MARKET INFORMATION SYSTEM
- OPVN: NATIONAL CEREALS' MARKETING BOARD
- WFP: WORLD FOOD PROGRAM
- MFP: MINISTRY OF FINANCE AND PLAN.

USAID MISSION
AMERICAN EMBASSY
NIAMEY, NIGER
US DEPT OF STATE NIAMEY 001235/680

ANNEX 3

NIGER COUNTRY MANUAL
SAMPLE OUTLINE

List of Acronyms

I. History of Early Warning and FEWS in Niger

- A. History of Famine
- B. History of Early Warning
- C. History of FEWS

II. Current Early Warning Activities in Niger

- A. USAID/Niger
  1. institutional structure
  2. current staff/contacts
  3. reporting and use of information
  4. FEWS' participation/interaction

- B. National Early Warning System
  1. institutional structure
  2. current staff/contacts
  3. reporting and use of information
  4. FEWS' participation/interaction

III. Data: Sources, Status, Use, How/Where Stored

- A. Physical Data
  1. Rain Gauge
  2. METEOSAT (rainfall estimate)
  3. NDVI
  4. Maps
  5. Crop Condition
  6. Pest Control
  7. Pastoral Conditions
  8. Agricultural Productions
  9. Livestock Productions

ANNEX 3

B. Socioeconomic Data
    1. Demographic Data
    2. Prices
    3. Food Stocks
    4. Food Aid

C. Health/Nutrition Data
D. Consumption Data
E. Other

IV. Methodologies/Procedures

A. Food Security Operations Cables (FSOCs)
B. Trimestrals
    1. PreHarvest Assessment
    2. Harvest Assessment
    3. Vulnerability Assessment

C. Food Balance
    1. USAID/Niger
    2. GON/CILSS

D. Population Projections
    1. People
    2. Animals

E. Rapid Assessments
F. Cereal/Livestock Terms-of-Trade

V. FFR Roles

A. USAID/Niger (Mission)
B. Early Warning Community
C. GON
D. FEWS/W

VI. Administrative Methods/Procedures

A. Communications with FEWS/W
B. Facility Management
C. Personnel - Assistant FFR
D. Travel